Sea Cucumber Biomass Estimations from Surveys Conducted June 2010 to May 2011

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ABSTRACT

Duprey, N.M.T. 2012. Sea cucumber biomass estimations from surveys conducted June 2010 to May 2011. Can. Manuscr. Rep. Fish. Aquat. Sci. 2960: xi + 150 p.

Stock assessment surveys of the sea cucumber, *Parastichopus californicus*, population in British Columbia have been ongoing since 1998. Between June 2010 and May 2011, six surveys were conducted to provide managers with population density and biomass estimates. The relative abundance of red sea urchin (*Strongylocentrotus franciscanus*), green sea urchin (*Strongylocentrotus droebachiensis*), and geoduck (*Panopea generosa*) were also measured and are presented here. The Area 3 North and Area 12 Sointula surveys did not have high sea cucumber densities with many Subareas lacking sufficient densities for a commercial fishery. The Princess Royal Channel (with Tolmie Channel habitat removed), Jervis Inlet – Sechelt and Area 18 South Gulf Island surveys had higher sea cucumber densities, with most Subareas having sufficient densities to support a commercial fishery. Locations for no-take reserve areas are suggested.

RÉSUMÉ

Duprey, N.M.T. 2012. Sea cucumber biomass estimations from surveys conducted June 2010 to May 2011. Can. Manuscr. Rep. Fish. Aquat. Sci. 2960: xi + 150 p.

Des relevés des stocks de concombres de mer du Pacifique (*Parastichopus californicus*) ont été complétés en Colombie-Britannique depuis 1998. De juin 2010 à mai 2011, six relevés ont fourni des estimés de densités et de biomasses aux gestionnaires. Les abondances qualitatives relatives d'oursin rouge (*Strongylocentrotus franciscanus*), d'oursin vert (*S. droebachiensis*) et de panope du Pacifique (*Panopea generosa*), sont présentées. Les densités dans le secteur 3 nord et le secteur 12 Sointula étaient trop basses pour supporter la pêche commerciale. Les densités de concombres de mer dans le Canal Princess Royal (excluant le Canal Tolmie), les bras de mer Jervis et Sechelt ainsi que le secteur 18 Îles du Golfe Sud, étaient assez élevées pour supporter la pêche commerciale dans la plupart des sous-secteurs.

INTRODUCTION

The fishery for giant red sea cucumber, *Parastichopus californicus* (Stimpson, 1857), in British Columbia (BC) had an annual value of approximately 4.3 million Canadian dollars in 2010 (P. Ridings, Fisheries and Oceans Canada (DFO), pers. comm.). Landings were first recorded in Canada in 1971, and the fishery underwent several management changes through the 1980's and 1990's. Since 1995, the fishery has undergone a rigorous period of data collection, analysis and information review. The objective was to develop a biologically-based stock assessment program and risk-averse fishery management. The first stock assessment and quota options paper was completed in 1995, utilizing a surplus production model (Phillips and Boutillier 1998). In the course of conducting this assessment, gaps in knowledge of the species' biology were identified and shortcomings of the fishery-dependent data became clear. Phillips and Boutillier (1998) identified the need for a change in approach for the BC sea cucumber fishery and laid the groundwork for a more comprehensive, Phase 0 (*fide* Perry et al. 1999), review in 1996 (Boutillier et al. 1998). The Phase 0 review paper concluded that the fishery was not providing the information necessary for stock assessments and evaluation of the impacts of the commercial fishery on sea cucumber populations. Accordingly, it was recommended that the fishery henceforth be conducted in a manner that would provide the necessary data. Phase 1 of the sea cucumber fishery began in 1997 (Hand and Rogers 1999), wherein the area open to commercial harvest was restricted to a static 25% of the coast, 50% of the coast was closed to harvest, and the remaining 25% of the coast was set aside for experimental fishery research. Only a small fraction of the area set aside for experimental fishery research was used; therefore the closed area encompassed almost 75% of the coast. A fishery-independent survey program was initiated in areas open to commercial harvest (termed 'Open' surveys) in BC. These Open surveys are used to determine the density and biomass of sea cucumbers in a given area.

After 10-years of fisheries-dependent and -independent research conducted in the Phase 1 regime, the data collected from Open surveys, experimental fisheries and biological sampling were analyzed and the results and recommendations were presented to and accepted by the Pacific Invertebrate Subcommittee of the Canadian Science Advisory Secretariat (CSAS) in 2007 (Hand et al. 2009). The recommendation to allow re-opening of the commercial fishery beyond the geographically-restricted area of 25% of the shoreline, using BC-based exploitation rates, was endorsed. It was also recommended and approved that any re-opened areas should be surveyed prior to the occurrence of commercial harvesting (Hand et al. 2009; Duprey et al. 2011). The sea cucumber fishery then entered Phase 2, 'fishing for commerce' (Perry et al. 1999).

Prior to re-opening areas in BC to commercial harvesting, surveys were conducted to estimate the density and biomass of sea cucumbers within them. A total of 80 new Pacific Fishery Management (PFM) Subareas have been surveyed from July 2007 through May 2010, and survey results have provided site-specific estimates of sea cucumber density and biomass. The integrated Fishery Management Plan (DFO 2010) lists all PFM Subareas currently open for commercial harvest of sea cucumber.

This manuscript report presents the results of five Open surveys conducted between June 2010 and May 2011: two Open surveys in the North Coast region (Area 3 North and Princess Royal Channel); and three Open surveys in the East Coast of Vancouver Island region (Area 12 Sointula, Jervis Inlet – Sechelt and Area 18 South Gulf Islands). This report also presents results for one permanent BioTransect in the Central Coast region (Kildidt Sound).

All five of the Open surveys were not open to fishing at the time of survey, but were being considered for opening in upcoming harvest seasons. The permanent BioTransect survey was conducted in the original 25% of the coastline that remained open in 1998, but had never been surveyed.

This report summarizes the survey protocols, describes the survey methodology and presents the results of data analysis for density, mean weight and biomass of the *Parastichopus californicus* populations, density estimates for the *Cucumaria miniata* and *C. pallida* sea cucumber populations and relative abundance estimates of geoducks (*Panopea generosa*), red sea urchins (*Strongylocentrotus franciscanus*) and green sea urchins (*S. droebachiensis*).

METHODS

Open surveys are the standard survey method used in BC to assess the *Parastichopus californicus* population (Duprey et al. 2011). They are used to assess density and biomass in areas currently open to commercial harvesting or to assess areas currently not open, yet there is a desire to re-open the area in upcoming years. Permanent BioTransect surveys are conducted in areas open to commercial harvesting. They provide the estimates of mean weight used in biomass calculations; and can be calculated every couple of years with minimal effort (Duprey et al. 2011). They do not provide any density estimates.

OPEN SURVEY METHODS

Surveying

While each Open Survey was prepared separately, the methods used to prepare and conduct each survey are the same. Firstly, the entire shoreline of the each PFM Subarea was measured using ArcGIS 9.3 (Table 1). The basemap used to measure the shoreline was the cucland.shp dataset, projected in BC Albers. Using the ArcGIS 9.3 measurements, transect locations were determined by placing transects systematically every two kilometers along the shoreline using Xtools (see Table 1 for total number of surveyed transects by PFM Subarea). One transect was allocated for every 2 kilometers of shoreline located in the PFM Subarea.

Each transect was surveyed by two SCUBA divers. A marked leadline was placed in a perpendicular line to shore, from zero gauge depth to 15.2 m gauge depth. The leadline was marked with zapstraps and coloured electrical tape at 5 m intervals called quadrats. A buoy was anchored to the deep end of the line at approximately 15.2 m (50 ft). Two divers descended the buoy line at this depth and began the survey. Each diver had a 2 m

pole with an attached datasheet. One diver was designated as the left diver and the other, the right; each diver was responsible for counting and recording on their datasheet the number of sea cucumbers within each quadrat on their side of the transect line. The left diver was responsible for counting the sea cucumbers straddling the transect line. For each quadrat, the following were recorded: the number of adult and the number juvenile (sea cucumbers less than 15 cm, the size of the pencil used by divers) *Parastichopus californicus*, no more than three dominant substrate types and no more than two dominant algae types. A sea cucumber was considered inside the quadrat if more than half of the animal was within the quadrat. The depth of each quadrat was also recorded. Only one diver recorded the number of *Cucumaria miniata* and *C. pallida* observed on their side of the transect. Because the white tentacles of *C. pallida* can be confused with those of *Eupentacta spp.*, some *Eupentacta* may be included in the *C. pallida* numbers presented in this report. As only one diver was recording this information, the swath covered was limited to their pole length of 2 m as compared to the 4 m wide swath covered for *P. californicus*, where both divers count animals. Relative abundance estimates of red sea urchins, green sea urchins and geoducks were also recorded on the dive regardless of how far they were seen from the transect line; each transect was designated as having either 'None, Few (1–10), Many (11–100) or Abundant (100+) animals.

Biosampling

The average weight and weight-frequency distribution of the populations was determined from biosamples, which were small collections of *P. californicus* that were individually weighed. Biosamples were collected from predetermined transects that were randomly selected from all transect locations. Approximately one biosample is collected for every 10 transects in an Analysis Area. After these selected transects were surveyed, the divers handpicked 25 sea cucumbers from the transect line and surrounding area up to maximum depth of 15.2m. Juveniles are not collected during biosampling and therefore their weights are excluded from biomass calculations. The animals were then brought on board the boat, where they were longitudinally split, left to drain and, at the end of the day, individually weighed. A total of 63 biosamples were collected from the five Open surveys presented in this report (the sampling protocol for permanent BioTransects collected in Kildidt Sound are described in the next section).

PERMANENT BIOTRANSECTS

Permanent BioTransects were developed so that the mean sea cucumber weight for an area could be surveyed with minimal effort. Transects were constructed by placing a cement block at the shallow and deep (15.2 m) ends at the chosen location and laying a ground line between the two blocks. Permanent BioTransects are set up in un-surveyed PFM Subareas to provide data on sea cucumber mean weight for biomass calculations (Duprey et al. 2011). BioTransects were surveyed by two divers, who collect every sea cucumber encountered within 2 m of the line. The animals were then brought on board the boat where they were longitudinally split and left to drain. When the survey was complete, they were transported to a dock where a biologist individually weighed them.

SURVEY AREA DESCRIPTIONS

The five Open surveys were conducted June 2010 through May 2011 and stretched from the Alaskan border to the Southern Gulf Islands on the east coast of Vancouver Island. One permanent BioTransect survey was established in Kildidt Sound.

Area 3 North

Area 3 North is located entirely within Pacific Fisheries Management Area (PFMA) 3, located in the North Coast region (Figures 1–15). This area had been closed to sea cucumber harvesting since 1998; it was surveyed for potential re-opening, and included seven previously unsurveyed PFM Subareas (3–11 to 3–17). The survey was conducted from April 28 – May 4, 2011 onboard two commercial fishing vessels. A DFO biologist and contract biologist were present for the 7 days of surveying. No other dive fishery had previously operated in the area and relatively little is known about the habitat or environment in the PFM Subareas.

PFM Subarea 3–11 is located on the northern shore of Wales and Pearce Islands, near the USA-Canada border. PFM Subarea 3–12 is made up of the northern section of Portland Inlet, the west side of Pearse Island (from Portland Point to Lizard Point) and the section of mainland from Trefusis Point to Low Point. PFM Subarea 3–13 is located north of Spit Point in Portland Canal up to Belle Bay. PFM Subarea 3–14 made up of Observatory Inlet, only the southern section (below Salmon Cove and Dawkins Point) was surveyed. PFM Subarea 3–15 and PFM Subarea 3–16 are the central and northern sections of Portland Canal, respectively. PFM Subarea 3–17 is located between the northern tip of Pearce Island and the mainland, providing a passage connecting Portland Inlet to Portland Canal. The total shoreline length of all 7 PFM Subareas was measured as 351.5 km using ArcGIS 9.3.

Princess Royal Channel

Princess Royal Channel is located in PFMA 6, located in the North Coast region (Figure 1). This area had been closed to sea cucumber harvesting since 1998 and was surveyed for potential re-opening. The survey included five previously unsurveyed PFM Subareas, 6–20 to 6–24 (Figures 16–25) and was conducted onboard a commercial fishing vessel between April 19–26 2011. A DFO biologist was present for the entire 8 days of surveying.

PFM Subarea 6–20 is made up of Princess Royal Channel, including Fraser Reach, Graham Reach and Tolmie Channel. Only the shoreline north of Netherby Point, near Green Inlet, was surveyed, as Tolmie Channel is currently being used as an Experimental Fishing Area for research on sea cucumber harvest rates. PFM Subarea 6–21 is made up of Klekane Inlet. PFM Subarea 6–22 is defined as Aaltanhash Inlet and PFM Subarea 6–23 is defined as Khutze Inlet. PFM Subarea 6–24 is defined as Green Inlet. The total shoreline length of all 5 PFM Subareas was measured as 211.1 km using ArcGIS 9.3.

Area 12 Sointula

The Area 12 Sointula Open survey was located in the PFMA 12, which is located in the East Coast of Vancouver Island region (Figure 1). This area had been closed to sea cucumber harvesting since 1998 and was surveyed for potential re-opening. The survey included 6 PFM Subareas, 12–3 to 12–5, and 12–19 to 12–21 (Figures 26–33) and was conducted from September 29 – October 7, 2010 onboard a commercial fishing vessel. A DFO biologist was present for the 9 days of surveying.

PFM Subarea 12–3 comprises the northern section of Johnston Strait. This includes the area west of a north-south line drawn through Escape Reef up to the southwest side of Hanson Island and Blinkhorn Peninsula. PFM Subarea 12–4 is the stretch of shoreline from Lewis point to Blinkhorn Peninsula; it includes Beaver Cove and Bauza Cove. PFM Subarea 12–5 is made up of the northern side of Hanson Island, the Southern side of Swanson Island, and the western part of Baronet Passage. PFM Subarea 12–18 includes the southern section of Malcolm Island, the northern section of Cormorant Island, and all of Haddington Island, and the Pearse Island group. PFM Subarea 12–19 is made up the shoreline between Ledge Point and Lewis Point on Vancouver Island, as well as the southern part of Cormorant Island. PFM Subarea 12–21 is made up of Growler Cove and the Sophia Islands. The total shoreline length of all five PFM Subareas was measured as 278.3 km using ArcGIS 9.3.

Jervis Inlet – Sechelt

The Jervis Inlet – Sechelt Open survey was located in the PFMA 16, located in the East Coast of Vancouver Island region (Figure 1). This area had been closed to sea cucumber harvesting since 1998 and was surveyed for potential re-opening. The survey included 11 PFM Subareas, 16–5 to 16–15 (Figures 34–55) and was conducted from February 2–11 2011 onboard two commercial fishing vessels. A DFO biologist and contract biologist were present for the 10 days of surveying.

PFM Subarea 16–5 is made up of the southern end of Sechelt Inlet. The Subarea includes all the shoreline south of Piper and Tuwanek Points including Porpoise Bay. PFM Subarea 16–6 continues north from the boundary of 16–5; its northern boundary is Skookum Island. PFM Subarea 16–7 is the whole of Salmon Inlet from Nine Mile Point to Kunechin Point. PFM Subarea 16–8 is all of Narrow Inlet, from Sockeye Point to Highland Point. PFM Subarea 16–9 is located at the Skookumchuck Narrows; all the shoreline north of Skookum Island and south of Egmont Point and the most northerly tip of Sechelt Peninsula are included in this Subarea. A total of 5.8 km of shoreline was removed from the Subareas total shoreline due to the Skookumchuck Narrow Provincial Park. PFM Subarea 16–10 is bounded in the north by Nile Point and the most northerly tip of Sechelt Peninsula and is bounded in the south by Fearney Point and the Sakinaw Lake River. PFM Subarea 16–11 only had the southern side surveyed as the northern side of the Subarea is resting after being used for many years as a long term Experimental Fishing Area. The southern section of the Subarea is defined as the northern side of Hardy Island, the northeastern side of Nelson Island and Captain Island. PFM Subarea 16–12 is located in Hotham Sound; it includes all the shoreline between Foley Head and Culloden Point. PFM Subarea 16–13 is located in Prince of Wales Reach; it includes all

the shoreline between Egmont Point and Foley Head in the south to Seshal Creek and Glacial Creek in the north. PFM Subarea 16–14 continues north from Subarea 16–13; it is bounded in the north by Patrick Point and a point slightly north of Deserted Bay. PFM Subarea 16–15 continues north of Subarea 14 and includes Queens Reach and Princess Louisa Inlet. The total shoreline length of all 11 PFM Subareas in the Jervis Inlet – Sechelt survey was measured as 519.9 km using ArcGIS 9.3.

Area 18 South Gulf Islands

The Area 18 South Gulf Islands Open survey was located in PFMA 18, located in the East Coast of Vancouver Island region (Figure 1). This area had been closed to sea cucumber harvesting since 1998 and was surveyed for potential re-opening. The survey included 9 PFM Subareas, 18–1 to 18–6 and 18–9 to 18–11 (Figures 56–71) and was conducted from February 18 – June 14 2011 onboard a commercial fishing vessel. A DFO biologist was present for the 15 days of surveying.

PFM Subarea 18–1 includes the outside sections of Mayne and Samuel Islands. The shoreline sections included are from Georgina Point to Campbell Point on Mayne Island and from Grainger Point to Ralph Grey Point on Samuel Island. PFM Subarea 18–2 includes the Active Pass area and the north coast of Provost Island. PFM Subarea 18–3 includes the Ganges and Long Harbour out to Yeo Point on Saltspring Island and the south coast of Provost Island. PFM Subarea 18–4 includes the west sides of North Pender Island and South Pender Island, the southeast coast of Provost Island and the east coast of Moresby Island. PFM Subarea 18–5 includes the east coasts of North Pender Island and South Pender Island, the south coast of Mayne Island and the south coast of Saturna Island. PFM Subarea 18–6 includes the northern part of Saanich Peninsula (from Moses Point to Curteis Point), Coal Island, Piers Island, Portland Island, the west side of Moresby Island, and the southern part of Saltspring Island (from Cape Keppel to Beaver Point, excluding Fulford Harbour). PFM Subarea 18–9 is a very small section of Provost Island form Portlock Point to Bright Islet. PFM Subarea 18–10 includes Fulford Harbour including all the shoreline from Eleanor Point to Isabella Point. PFM Subarea 18–11 includes Tumbo Island and the outside section of Saturna Island from Winter Point to East Point. The total length of the shoreline in the surveyed area was measured as 356.0 km using ArcGIS 9.3.

Kildidt Sound

The Kildidt Sound permanent BioTransect survey was located in PFMA 7 in the Central Coast region (Figure 1). This area had been open to sea cucumber harvesting since 1998 but had never been surveyed. The area is made up of two PFM Subareas 7–27 and 28; ranked 15th and 25th on the priority list of unsurveyed areas in Duprey et al. (2011). The survey was constructed and conducted from September 28 – October 1 2010 onboard a commercial fishing vessel. A contract biologist was present at the end of the survey to weigh the animals.

PFM Subarea 7–27 includes the outer section of Kildidt Sound. Many islands are part of this Subarea including Spider, Spitfire, Hurricane, Edna, Manley, Ronald, Triquet, Kidney, and Serpent Islands. PFM Subarea 7–28 includes the inner area of Kildidt

Sound, Kildidt Inlet and Kildidt Lagoon most of the shoreline of this Subarea is located on Hunter Island.

DATA ANALYSIS

Density estimations

For statistical analysis, the linear density of *P. californicus, C. miniata and C. pallida* for each transect was calculated by dividing the total number of sea cucumbers by the width of the transect (4 m for *P. californicus* and 2 m for *C. miniata* and *C. pallida*). On a PFM Subarea basis, the transect data were analyzed using the CukeAnalysis Program (version 2008 11 19), which calculates the mean density and confidence bounds using the bootstrapping technique (see Hand et al. [2009] for more details). Transect data were re-sampled with 1000 iterations using a random seed of 756. Some PFM Subareas were small and therefore had sample sizes too low to obtain good results from bootstrapping (a minimum of 10 transects is preferred). Analysis Areas were developed to avoid this complication: PFM Subareas in the same survey were pooled with other PFM Subareas that had similar bathymetry and geographical shape, and analyzed as one (see Table 1 for a list of Analysis Areas). The mean *P. californicus, C. miniata and C. pallida* density, and 75%, 90%, 95%, 99% confidence bounds were calculated for each Subarea or Analysis Area.

Mean weight estimations

Biosamples were used to obtain estimates of mean weight for each PFM Subarea. The individual weights of each sea cucumber in a biosample (approximately 25 sea cucumbers) were averaged to produce a mean biosample weight from the sampled transect. The mean weight estimate for a Subarea is the mean of all the biosample averages collected from transects within that Subarea (Duprey et al. 2011). If no biosample was collected from a Subarea, the lowest mean weight estimate of all Subareas in the same survey was used (Duprey et al. 2011).

Biomass estimations

The biomass by PFM Subarea is estimated at various confidence bounds (CB) using the following formula

$$Biomass_{CB} = [(Shoreline_{Protected} * Density_{CB}) * Wt_{mean}] + [(Shoreline_{Exposed} * 2.5) * Wt_{mean}]$$

where $Density_{CB}$ is the density from the bootstrap output and Wt_{mean} is the mean individual sea cucumber weight attributed to the Subarea from biosampling (Duprey et al. 2011). The shoreline length used to calculate biomass was measured using the GIS software Compugrid and is currently housed in the managers database. $Shoreline_{exposed}$ is the cumulative shoreline in a Subarea that has been designated exposed in the BC Shorezone dataset (Hand et al. 2009; Duprey et al. 2011). $Shoreline_{protected}$ is the cumulative shoreline in a Subarea that has been designated Semi-Exposed to Very Protected (Duprey et al. 2011). If the $Density_{CB}$ value is lower than 2.5, then ($Shoreline_{Exposed} * 2.5$) is replaced with the [($Shoreline_{Exposed} * Density_{CB}$). See Duprey et al. (2011) for a detailed description of methods used to calculate biomass estimates.

RESULTS

DENSITY SURVEYS

The following sections describe the results of analyses of the transect densities, biosample weights and biomass estimations for each Subarea. Exact density estimates for transects are listed in Tables 5 to 9, while the figures indicate the position of a transect and use different symbols for density ranges. The density ranges developed for the figures were chosen for their relevance to stock assessment benchmarks and differ by Analysis Areas. There are as many as five possible categories of density ranges in each figure. Absence of sea cucumbers (0.0 sea cucumbers/metre of shoreline (c/m-sh)) and up to 2.49 c/m-sh are used in every figure. Zero was chosen as a category to aid in determining areas where no sea cucumbers were seen. The next category range of 0.01 to 2.49 c/m-sh was chosen because a 90% lower confidence bound (LCB) of 2.50 c/m-sh, for an Analysis Area is required before re-opening is recommended. The remaining three category ranges differ depending on the survey location and the results of the analysis. The third density range is between 2.50 c/m-sh and either the regional baseline density or the 90% LCB of the bootstrapped transect densities, whichever is lower. Baseline densities are densities attributed to un-surveyed open areas within a region, as follows: North Coast = 6.0 c/m-sh; Central Coast = 6.0 c/m-sh; East Coast Vancouver Island = 4.1 c/m-sh; and West Coast Vancouver Island = 1.9 c/m-sh (Duprey et al. 2011). The forth density range is from the regional baseline density to the 90% LCB, or vice versa depending on which is lower. If the maximum observed density is low, the upper end if the forth range is the maximum observed density in the Analysis Area. The final range in the figures is from the 90% LCB (or regional baseline density) to the maximum density observed in the Analysis Area. If the maximum observed density is less than the baseline density then this category is not present.

PFMA 3–11 (Area 3 North)

Parastichopus californicus

PFMA 3–11 had the highest *P. californicus* densities observed in the entire Area 3 North survey (Table 2). Densities were higher in the southern part of the Subarea (Figure 2a,b). A total of 12 of the 34 transects surveyed had a density of less than 6.0 c/m-sh (Table 5). The highest transect density observed was 42.0 c/m-sh and the lowest 0.0 c/m-sh.

The DFO management database has a total shoreline length for Subarea 3–11 of 78,053 m, all of which is classified as having Protected exposure in the BC Shorezone classification system. Winter Inlet, representing 17,978 m of shoreline, was removed from the total shoreline length as the area will remain closed to harvesting; the inlet was surveyed (transects 19 to 27) but the data were not included in the analysis. Therefore, the total shoreline length used for biomass calculations was 60,075 m.

Mean sea cucumber density was estimated to be 9.5 c/m-sh with a 90% LCB of 7.5 c/m-sh (Table 2). An average weight was calculated from each of the 3 biosamples (transects 10, 15, and 35; Table 3); the average of these 3 values was 254 g (Table 3). The 90% LCB of the mean biomass estimate was 114,443 kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded for all 34 transects surveyed in the Subarea. Nineteen of the 34 transects surveyed had no observed *C. miniata* and the highest density observed was 75.0 c/m-sh (Table 5). The mean density was estimated to be 7.4 c/m-sh with a 90% LCB of 4.2 c/m-sh. Using the corrected shoreline length and the 90% LCB of the density, the estimated population of *C. miniata* was 252,315.

Twenty-eight of the 34 transects surveyed had no *C. pallida* observed and the highest density observed was 1.5 c/m-sh (Table 5). The mean density was estimated to be 0.1 c/m-sh with a 90% LCB of 0.0 c/m-sh. The calculated 90% LCB of the estimated population of *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected from all 34 transects surveyed in Subarea 3–11. A 'few' geoducks were seen on 1 (3%) transect, while the remaining 33 (97%) transects had no geoducks observed (Figure 3a, b). 'Abundant' green sea urchins were seen on 2 (6%) transects, 'Many' were seen on 3 (9%) transects, 6 (18%) transects had 'Few' and 23 (68%) transects had no green sea urchin observed. No red sea urchins were observed (Figure 3a, b).

PFMA 3–12 (Area 3 North)

Parastichopus californicus

PFMA 3–12 had low densities of *P. californicus* throughout the Subarea, except for the west side of Mylor Peninsula which appears to have slightly higher densities (Figure 4). A total of 21 of the 24 transects surveyed had a density of less than 6.0 c/m-sh (Table 5). The highest density observed was 11.75 c/m-sh and 12 transects had 0 c/m-sh.

The shoreline segments east of Nass Point and Low Point were removed as they were not surveyed and not part of this analysis. The DFO management database has a total shoreline length for Subarea 3–12 west of Nass Point and Low Point of 47,408 m, of which 2,739 m is classified as Exposed and 44,669 m classified as Protected by the BC Shorezone classification system.

Mean sea cucumber density was estimated to be 2.0 c/m-sh with a 90% LCB of 1.1 c/m-sh (Table 2). No biosamples were taken in this Subarea so, following Duprey et al. 2011, the lowest mean weight estimate from the entire Area 3 North survey (174 g) was used as the mean weight. The 90% LCB of the mean biomass estimate for PFMA 3–12 was 11,233 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on 13 of the 24 transects surveyed in the Subarea. Six of the 24 transects surveyed had no *C. miniata* observed and the highest density observed was 18.0 c/m-sh (Table 5). The mean density

was estimated to be 2.4 c/m-sh with a 90% LCB of 0.6 c/m-sh. Using the entire shoreline length of the Subareas and the 90% LCB of the density, the estimated population of *C. miniata* was 28,445 in Subarea 3–12.

Ten of the 24 transects surveyed had no *C. pallida* observed and the highest density observed was 1.0 c/m-sh (Table 5). The mean density was estimated to be 0.2 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subareas and the 90% LCB of the density, the estimated population of *C. pallida* was 0 individuals in Subarea 3–12.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected from 23 of the 24 transects surveyed in Subarea 3–12. No geoducks were observed (Figure 5). Green sea urchins were more abundant than red sea urchins in Subarea 3–12. 'Few' red sea urchins were seen on 2 (9%) transects and zero on the remaining 21 (91%) transects (Figure 5). Green sea urchins were 'Abundant' on 4 (17%) transects, 'Many' were seen on 3 (13%) transects, 'Few' were seen on 5 (22%) transect and 11 (48%) transects had none observed.

PFMA 3–13 (Area 3 North)

Parastichopus californicus

PFMA 3–13, southern Portland Canal, had low but consistent *P. californicus* densities. Densities were lower at the northern and southern boundaries of the Subarea and higher densities were found across from Halibut Bay (Figure 6). A total of 10 of the 12 transects surveyed had a density of less than 6.0 c/m-sh, the regional baseline density used for Open areas with no survey data (Table 5). The highest density observed was 8.00 c/m-sh and the lowest 1.25 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 3–13 of 27,451 m, all of which was classified as Protected by the BC Shorezone classification system.

Mean sea cucumber density was estimated to be 3.3 c/m-sh with a 90% LCB of 2.4 c/m-sh (Table 2). An average weight was calculated from each of the two biosamples (transects 78 and 92; Table 3); the average of these two values was 215 g (Table 3). The 90% LCB of the mean biomass estimate was 11,871 kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on all 12 transects surveyed in the Subarea. Nine of the 12 transects surveyed had no *C. miniata* observed and the highest density observed was 35.0 c/m-sh (Table 5). The mean density was estimated to be 4.3 c/m-sh with a 90% LCB of 1.3 c/m-sh (in a table?). Using the entire shoreline length of Subarea 3–13 and the 90% LCB of the density, the estimated population of *C. miniata* was 35,687 sea cucumbers.

Eleven of the 12 transects surveyed had no *C. pallida* observed. The single transect with observed animals had a density of 0.5 c/m-sh (Table 5). The mean density was estimated

to be 0.0 c/m-sh with a 90% lower confidence bound of 0.0 c/m-sh. Using the entire shoreline length of Subarea 3–13 and the 90% LCB of the density, the estimated population of *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected from all 12 transects surveyed in Subarea 3–13. Geoducks were not seen on any of the transects (100%) (Figure 7). No red sea urchins were seen on the 12 (100%) transects surveyed. 'Abundant' green sea urchins were seen on 1 (8%) transect, 'Many' were seen on 1 (8%) transect, 1 (8%) transect had 'Few' and zero on the remaining 9 (75%) transects.

PFMA 3–14 (Area 3 North)

Parastichopus californicus

In PFMA 3–14, only the section of Observatory Inlet south of Salmon Cove was surveyed (Figure 8). Overall, there were low *P. californicus* densities throughout this section of Observatory Inlet. All of the 23 transects had a density less than 6.0 c/m-sh (Table 5) and 17 of the transects had no *P. californicus* observed. The highest density observed was 5.50 c/m-sh and the lowest was 0 c/m-sh.

The shoreline north of Salmon Cove and Dawkins Point were removed as they were not surveyed and not part of this analysis. The DFO management database has a total shoreline length for Subarea 3–14, south of Salmon Cove and Dawkins Point, of 44,659 m. Of which 113 m is classified as Exposed and 44,546 m is classified as Protected by the BC Shorezone classification system.

Mean sea cucumber density was estimated to be 0.5 c/m-sh with a 90% LCB of 0.2 c/m-sh (Table 2). An average weight of 223 g was calculated from the one biosample (transect 99; Table 3). The 90% LCB of the mean biomass estimate was 1,990 kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on 22 of the 23 transects surveyed in the Subarea. Sixteen of the 22 transects surveyed had no *C. miniata* observed and the highest density observed was 2.5 c/m-sh (Table 5). The mean density was estimated to be 0.3 c/m-sh with a 90% lower confidence bound of 0.1 c/m-sh. Using the entire shoreline length of Subarea 3–14 and the 90% LCB of the density, the estimated population of *C. miniata* was 4,466 sea cucumbers. No *C. pallida* were observed on any of the 22 transects surveyed (Table 5).

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected for 22 of the 23 transects surveyed in Subarea 3–14. No geoducks or red sea urchins were observed on any of the transects (Figure 9). 'Abundant' green sea urchins were seen on 4 (18%) transects, 'Many' were seen on 4 (18%) transects, 'Few' on 4 (18%) transects and 10 (46%) transects had no green sea urchin observed.

PFMA 3–15 (Area 3 North)

Parastichopus californicus

PFMA 3–15, central Portland Canal, had slightly higher densities of *P. californicus* in the southern section of the Subarea (Figure 10). All of the 35 transects surveyed had a density of less than 6.0 c/m-sh (Table 5). The highest density observed was 5.25 c/m-sh and the lowest was 0 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 3–15 of 65,302 m all of which is classified as Protected by the BC Shorezone classification system.

Mean sea cucumber density was estimated to be 1.0 c/m-sh with a 90% LCB of 0.7 c/m-sh (Table 2). An average weight was calculated from each of the two biosamples (transects 257, and 264; Table 3); the average of these two values was 180 g (Table 3). The 90% LCB of the mean biomass estimate was 8,236 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on all 35 transects surveyed in the Subarea. Thirty-two of the 35 transects surveyed had no *C. miniata* observed and the highest density observed was 1.5 c/m-sh (Table 5). The mean density was estimated to be 0.1 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 3–15 and the 90% LCB of the density, the estimated population of *C. miniata* was 0 sea cucumbers.

Thirty-two of the 35 transects surveyed had no *C. pallida* observed and the highest density observed was 2.5 c/m-sh (Table 5). The mean density was estimated to be 0.1 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 3–15 and the 90% LCB of the density, the estimated population of *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected for all 35 transects surveyed in Subarea 3–15. No geoducks or red sea urchins were observed on any transect in the Subarea (Figure 11). 'Abundant' green sea urchins were seen on 10 (28%) transects, 'Many' were seen on 2 (6%) transects, 'Few' were seen on 2 (6%) transects and 21 (60%) transects had none observed.

PFMA 3–16 (Area 3 North)

Parastichopus californicus

PFMA 3–16 had no *P. californicus* observed on any of the 10 transects surveyed (Figure 12; Table 5).

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 3–16 of 36,490 m all of which is classified as Protected by the BC Shorezone classification system.

Mean sea cucumber density was estimated to be 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh (Table 2). No biosamples were taken in this Subarea, so the lowest mean weight estimate from the entire Area 3 North survey, 174 g, was used as the mean weight (Table 3). The 90% LCB of the mean biomass estimate was 0 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* data was recorded on all 10 transects surveyed in the Subarea. No *C. miniata* or *C. pallida* were observed; the mean density was estimated to be 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh (Table 5). Using the entire shoreline length of Subarea 3–16 and the 90% LCB of the density the estimated population of *C. miniata* and *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected from all 10 transects surveyed in Subarea 3–16. Geoducks were not observed in the Subarea (Figure 13). No red sea urchins were observed (Figure 13). 'Abundant' green sea urchins were seen on 8 (80%) transects, 'Many' were seen on 1 (10%) transect and 1 (10%) transect had none observed.

PFMA 3–17 (Area 3 North)

Parastichopus californicus

PFMA 3–17 had higher *P. californicus* densities observed at the two northerly transects located near Portland Canal (Figure 14). A total of 10 of the 12 transects surveyed had a density of less than 6.0 c/m-sh; the highest density observed was 13.00 c/m-sh and 6 transects had 0.00 c/m-sh (Table 5).

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 3–17 of 22,949 m all of which is classified as Protected by the BC Shorezone classification system.

Mean sea cucumber density was estimated to be 2.7 c/m-sh with a 90% LCB of 1.0 c/m-sh (Table 2). An average weight of 174 g was calculated from the one biosample collected (transects 287; Table 3). The 90% LCB of the mean biomass estimate was 4,004 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on 9 of the 12 transects surveyed in the Subarea. Eight of the 9 transects surveyed had no *C. miniata* observed, the only density observed was 1.5 c/m-sh (Table 5). The mean density was estimated to be 0.2 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 3–17 and the 90% LCB of the density, the estimated population of *C. miniata* was 0 sea cucumbers.

All 12 of the transects surveyed had no *C. pallida* observed (Table 5). The mean density was estimated to be 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline

length of Subarea 3–17 and the 90% LCB of the density, the estimated population of *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected from all 12 transects surveyed in Subarea 3–17. Geoducks were not seen on any of the 12 transects (Figure 15). No red sea urchins were seen on any of the 12 transects (Figure 15). 'Abundant' green sea urchins were seen on 2 (17%) transects, 'Many' were seen on 1 (8%) trasnsect, 'Few' were seen on 3 (25%) transects and 6 (50%) transects had none observed.

PFMA 6–20 (Princess Royal Channel)

Parastichopus californicus

The density of *P. californicus* in PFMA 6–20 was well distributed with mostly strong densities greater than 6.0 c/m-sh (Figure 16a, b). A total of 15 of the 63 transects surveyed had a density of less than 6.0 c/m-sh (Figure 16a, b). The highest density observed was 58.00 c/m-sh and the lowest was 0.75 c/m-sh.

The Tolmie Channel Experimental Fishery Area (EFA) is located in PFMA 6–20. Everything south of Netherby Point at the mouth of Green Inlet should remain closed to commercial fishing to maintain this long-term harvest rate experiment. The DFO management database has a total length for Subarea 6–20 of 190,142 m all classified as Protected by the BC Shorezone classification system. A total of 70,774 m was removed to protect the EFA, leaving 119,368 m of shoreline that was surveyed.

Mean sea cucumber density was estimated to be 13.8 c/m-sh with a 90% LCB of 11.7 c/m-sh (Table 2). An average weight was calculated for each of the six biosamples (transects 9, 19, 25, 34, 45 and 54; Table 3); the average of these six values was 166 g (Table 3). The 90% LCB of the mean biomass estimate was 231,837 Kg for Subarea 6–20 (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on all 63 transects surveyed in the Subarea. Fifteen of the 63 transects surveyed had no *C. miniata* observed and the highest density observed was 153.5 c/m-sh (Table 6). The mean density was estimated to be 18.8 c/m-sh with a 90% LCB of 13.2 c/m-sh. Using the entire shoreline length of each Subarea and the 90% LCB of the density, the estimated population of *C. miniata* was 2,509,875 sea cucumbers in Subarea 6–20.

Thirty-one of the 63 transects surveyed had no *C. pallida* observed and the highest density observed was 12.5 c/m-sh (Table 6). The mean density was estimated to be 2.0 c/m-sh with a 90% lower confidence bound of 1.4 c/m-sh. Using the entire shoreline length of the Subarea and the 90% LCB of the density, the estimated population of *C. pallida* was 266,199 sea cucumbers in Subarea 6–20.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected from all 63 transects surveyed in Subarea 6–20. Geoducks were not seen in high numbers in the Subarea. 'Few' were seen on 2

(3%) transects and none were observed on the remaining 61 (97%) transects (Figure 17a, b).
There were more red sea urchins than green sea urchins in Subareas 6–20 (Figure 17a, b). 'Abundant' red sea urchins were seen on 17 (27%) transects, 'Many' on 27 (43%) transects, 'Few' on 12 (19%) transects and zero on the remaining 7 (11%) transects (Figure 17a, b). 'Abundant' green sea urchins were seen on 10 (16%) transect, 14 (22%) transects had 'Many', 20 (32%) transects had 'Few' and 19 (30%) transects had no green sea urchin observed.

PFMA 6–21 (Princess Royal Channel)

Parastichopus californicus

PFMA 6–21, Klekane Inlet, had higher *P. californicus* densities closer to Work Island and (Figure 18). A total of 7 of the 10 transects surveyed had a density of less than 6.0 c/m-sh (Figure 18). The highest density observed was 41.00 c/m-sh and the lowest was 0.25 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 6–21 of 19,387 m; of this area 1,338 m is classified as Exposed and the remaining 18,049 m is classified as Protected by the BC Shorezone classification system.

Mean sea cucumber density was estimated to be 8.3 c/m-sh with a 90% LCB of 4.2 c/m-sh (Table 2). An average weight of 184 g was calculated from the one biosample collected in the Subarea (transects 66; Table 3). The 90% LCB of the mean biomass estimate was 14,564 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* presence was recorded for all of the 10 transects surveyed in the Subarea. Four of the 10 transects surveyed had no *C. miniata* observed and the highest density observed was 76.5 c/m-sh (Table 6). The mean density was estimated to be 12.9 c/m-sh with a 90% LCB of 4.0 c/m-sh. Using the entire shoreline length of Subarea 6–21 and the 90% LCB of the density, the estimated population of *C. miniata* was 77,548 sea cucumbers.

Five of the 10 transects surveyed had no *C. pallida* observed and the highest density observed was 37.5 c/m-sh (Table 6). The mean density was estimated to be 6.0 c/m-sh with a 90% LCB of 2.1 c/m-sh. Using the entire shoreline length of Subarea 6–21 and the 90% LCB of the density, the estimated population of *C. pallida* was calculated to be 40,713 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected from 34 of the 36 transects surveyed in Subarea 6–21. No geoducks were seen in the Subarea (Figure 19).

There were more red sea urchins than green sea urchins in Subarea 6–21 (Figure 19). 'Many' red sea urchins were seen on 2 (20%) transects, 'Few' were seen on 5 (50%)

transects and zero on the remaining 3 (30%) transects (Figure 19). 'Many' green sea urchins were seen on 1 (10%) transects, 1 (10%) transects had 'Few', and 8 (80%) transects had no green sea urchin observed.

PFMA 6–22 (Princess Royal Channel)

Parastichopus californicus

PFMA 6–22 had high density areas of *P. californicus* spread throughout Aaltanhash Inlet (Figure 20). A total of 3 of the 10 transects surveyed had a density of less than 6.0 c/m-sh (Table 6). The highest density observed was 33.25 c/m-sh and the lowest was 0.5 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 6–22 of 14,885 m all of which is classified as Protected by the BC Shorezone classification system.

Mean sea cucumber density was estimated to be 11.4 c/m-sh with a 90% LCB of 7.4 c/m-sh (Table 2). An average weight of 254 g was calculated from the one biosample collected in the Subarea (transects 76; Table 3).The 90% LCB of the mean biomass estimate was 27,978 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on all 10 transects surveyed in the Subarea. Three of the 10 transects surveyed had no *C.miniata* observed and the highest density observed was 22.0 c/m-sh (Table 6). The mean density was estimated to be 6.0 c/m-sh with a 90% LCB of 3.2 c/m-sh. Using the entire shoreline length of Subarea 6–22 and the 90% LCB of the density, the estimated population of *C. miniata* was 47,632 sea cucumbers.

Three of the 10 transects surveyed had no *C. pallida* observed and the highest density observed was 7.5 c/m-sh (Table 6). The mean density was estimated to be 1.9 c/m-sh with a 90% LCB of 0.9 c/m-sh. Using the entire shoreline length of Subarea 6–22 and the 90% LCB of the density, the estimated population of *C. pallida* was calculated to be 13,397 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected all of the 10 transects surveyed in Subarea 6–22. Geoducks were seen in very low numbers in the Subarea. 'Few' geoducks were seen on 1 (10%) transect and in the remaining 9 (90%) transects no geoducks were observed (Figure 21).

Red sea urchins were observed in higher numbers than green sea urchins in Subarea 6–22. 'Many' red sea urchins were seen on 4 (40%) transects, 'Few' on 1 (10%) transect and zero on the remaining 5 (50%) transects (Figure 21). 'Many' green sea urchins were seen on 1 (10%) transect, 3 (30%) transects had 'Few' and 6 (60%) transects had no green sea urchin observed.

PFMA 6–23 (Princess Royal Channel)

Parastichopus californicus

PFMA 6–23 had low *P. californicus* densities near the Kutze River with stronger densities west of Pardoe Point (Figure 22). A total of 9 of the 13 transects surveyed had a density of less than 6.0 c/m-sh (Table 6). The highest density observed was 22.50 c/m-sh and the lowest was 0 c/m-sh.

The DFO management database has a total length for Subarea 6–23 of 25,049; 24,141 m is classified as Protected and 908 m is classified as Exposed by the BC Shorezone classification system.

Mean sea cucumber density was estimated to be 5.5 c/m-sh with a 90% LCB of 3.4 c/m-sh (Table 2). An average weight of 208 g was calculated from the one biosample collected in the Subarea (transects 93; Table 3). The 90% LCB of the mean biomass estimate was 17,545 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on all 13 transects surveyed in the Subarea. Seven of the 13 transects surveyed had no *C. miniata* observed and the highest density observed was 60.5 c/m-sh (Table 6). The mean density was estimated to be 8.3 c/m-sh with a 90% LCB of 3.0 c/m-sh. Using the entire shoreline length of Subarea 6–23 and the 90% LCB as the estimated density, the estimated population of *C. miniata* was 75,147 sea cucumbers.

Eight of the 13 transects surveyed had no *C. pallida* observed and the highest density observed was 3.5 c/m-sh (Table 6). The mean density was estimated to be 0.8 c/m-sh with a 90% LCB of 0.3 c/m-sh. Using the entire shoreline length of Subarea 6–23 and the 90% LCB as the estimated density, the estimated population of *C. pallida* was 7,515 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all 13 transects surveyed in Subarea 6–23. Geoducks were not seen in high numbers in the Subarea; most transects had no geoducks observed. 'Few' numbers were seen on 1 (8%) transects and none were seen on the remaining 12 (92%) transects (Figure 23).

Red sea urchins were observed in slightly higher numbers than green sea urchin throughout 6–23 (Figure 23). 'Abundant' red sea urchins were seen on 1 (8%) transect, 'Many' were seen on 2 (15%) transects, 'Few' were seen on 2 (15%) transects and zero on the remaining 8 (62%) transects (Figure 23). 'Many' numbers of green sea urchins were seen on 1 (8%) transect, 3 (23%) transects had 'Few' and 9 (69%) transects had no green sea urchin observed.

PFMA 6–24 (Princess Royal Channel)

Parastichopus californicus

PFMA 6–24 had high *P. californicus* densities throughout the Inlet (Figure 24). A total of 2 of the 10 transects surveyed had a density of less than 6.0 c/m-sh (Table 6). The highest density observed was 20.00 c/m-sh and the lowest was 2.5 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 6–24 of 17,624 m, of which 817 m is classified as Exposed and 16,807 m is classified as Protected by the BC Shorezone classification system.

Mean sea cucumber density was estimated to be 9.8 c/m-sh with a 90% LCB of 7.5 c/m-sh (Table 2). An average weight of 381 g was calculated from the one biosample collected in the Subarea (transects 102; Table 3). The 90% LCB of the mean biomass estimate was 48,804 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on all 10 transects surveyed in the Subarea. Four of the 10 transects surveyed had no *C. miniata* observed and the highest density observed was 40.5 c/m-sh (Table 6). The mean density was estimated to be 5.8 c/m-sh with a 90% LCB of 1.5 c/m-sh. Using the entire shoreline length of Subarea 6–24 and the 90% LCB of the density, the estimated population of *C. miniata* was 26,436 sea cucumbers.

Seven of the 10 transects surveyed had no *C. pallida* observed and the highest density observed was 4.0 c/m-sh (Table 6). The mean density was estimated to be 0.9 c/m-sh with a 90% LCB of 0.2 c/m-sh. Using the entire shoreline length of Subarea 6–24 and the 90% LCB of the density, the estimated population of *C. pallida* was 3,525 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 10 transects surveyed in Subarea 6–24. Geoducks were not seen in high numbers in the Subarea; most of the transects had no geoducks observed. 'Few' numbers were seen on 1 (10%) transect, and in the remaining 9 (90%) transects no geoducks were observed (Figure 25).

Red sea urchins were observed in slightly higher numbers than green sea urchin in Subarea 6–24 (Figure 25). 'Many' red sea urchins were seen on 2 (20%) transects, 'Few' on 2 (20%) transects and zero on the remaining 6 (60%) transects (Figure 25). 'Many' green sea urchins were seen on 1 (10%) transect, and the remaining 9 (90%) transects had no green sea urchin observed.

PFMA 12–3, 4 and 21 (Area 12 Sointula)

Parastichopus californicus

PFMA 12–3, 4 and 21 were all merged for analysis into one Analysis Area. High density and low densities of *P. californicus* were well distributed through Subarea 12–3, Growler Cove and Beaver Cove, in Subarea 12–4 and 12–21 respectively, both had low densities (Figure 26a, b, c). A total of 29 of the 51 transects surveyed had a density of less than 4.1 c/m-sh (Table 7). The highest density observed was 14.75 c/m-sh and the lowest was 0.0 c/m-sh.

No shoreline segments were removed from Subareas 12–3 and 21 due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 12–3 of 72,711 m of which 41 m is classified as Exposed and 72,670 m is classified as Protected by the BC Shorezone classification system. Subarea 12–21 has a total shoreline length of 10,198 m, also, all classified as Protected. Some of the shoreline of Subarea 12–4 was removed due to a large logging company occupying most of Beaver Cove; the remaining shoreline length in the Subarea was 9,051 m all of which is classified as Protected.

Mean sea cucumber density for the Analysis Area was estimated to be 4.3 c/m-sh with a 90% LCB of 3.6 c/m-sh (Table 2). Subarea 12–3 had an average weight calculated for each of the four biosamples (transects 15, 25, 36 and 47; Table 3); the average of these four values was 306 g (Table 3). No biosamples were collected in Subareas 12–4 and 21 so the lowest Subarea mean weight from the Area 12 Sointula survey, 205 g, was used for biomass calculations (Duprey *et al.* 2011). The 90% LCB of the mean biomass estimate for Subarea 12–3 was 80,085 Kg, Subarea 12–4 was 6,680 Kg and Subarea 12–21 was 7,526 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on all 51 transects surveyed in the Subarea. All of the 51 transects surveyed had no *C. miniata* observed (Table 7). The mean density was therefore 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 12–3, 4 and 21 and the 90% LCB of the density, the estimated population of *C. miniata* was 0 sea cucumbers.

All of the 51 transects surveyed had no *C. pallida* observed (Table 7). The mean density was therefore 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 12–3, 4 and 21 and the 90% LCB of the density, the estimated population of *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 51 transects surveyed in Subarea 12–3, 4 and 21. Geoducks were not seen on any of the transects in the Analysis Area (Figure 27a, b, c).

Red sea urchins were observed in higher numbers than green sea urchin in the Analysis Area (Figure 27a, b, c). 'Abundant' red sea urchins were seen on 15 (29%) transects,

'Many' on 16 (31%) of the transects, 'Few' on 3 (6%) transects and zero on the remaining 17 (33%) transects (Figure 27a, b, c). Green sea urchins were seen in 'Abundant' numbers on 6 (12%) transects, 'Many' on 9 (18%) transects, 'Few' on 16 (31%) transects and zero on the remaining 20 (39%) transects.

PFMA 12–5 (Area 12 Sointula)

Parastichopus californicus

PFMA 12–5 had mostly low densities of *P. californicus* spread throughout the Subarea (Figure 28). A total of 15 of the 19 transects surveyed had a density of less than 4.1 c/m-sh (Table 7). The highest density observed was 22.25 c/m-sh and the lowest was 0.00 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 12–5 of 53,693 m all of which is classified as Protected by the BC Shorezone classification system.

Mean sea cucumber density was estimated to be 2.4 c/m-sh with a 90% LCB of 1.1 c/m-sh (Table 2). An average weight was calculated from each of the two biosamples (transects 120 and 128; Table 3); the average of these two values was 286 g (Table 3). The 90% LCB of the mean biomass estimate was 16,892 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on 9 of the 19 transects surveyed in the Subarea. Six of the 19 transects surveyed had no *C. miniata* observed and the highest density observed was 19.5 c/m-sh (Table 7). The mean density was estimated to be 2.8 c/m-sh with a 90% LCB of 0.4 c/m-sh. Using the entire shoreline length of Subarea 12–5 and the 90% LCB of the density, the estimated population of *C. miniata* was 21,478 sea cucumbers.

All of the 19 transects surveyed had no *C. pallida* observed (Table 7). The mean density was therefore 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 12–5 and the 90% LCB of the density, the estimated population of *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on 16 of the 19 transects surveyed in Subarea 12–5. No geoducks were seen in the Subarea (Figure 29).

Red sea urchins were observed in higher numbers than green sea urchin in the Subarea (Figure 29). 'Abundant' red sea urchins were seen on 11 (69%) transect, 'Many' were seen on 1 (6%) transects, and zero on the remaining 4 (25%) transects. 'Many' green sea urchins were seen on 2 (13%) transects, 'Few' on 8 (50%) transects and 6 (37%) transects had no green sea urchin observed.

PFMA 12–18 (Area 12 Sointula)

Parastichopus californicus

PFMA 12–18 had consistently low *P. californicus* densities throughout the Subarea (Figure 30). A total of 23 of the 28 transects surveyed had a density of less than 4.1 c/m-sh (Table 7). The highest density observed was 15.75 c/m-sh and the lowest 0.00 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 12–18 of 71,551 m all of which is classified as Protected by the BC Shorezone classification system.

Mean sea cucumber density was estimated to be 2.5 c/m-sh with a 90% LCB of 1.6 c/m-sh (Table 2). An average weight was calculated from each of the three biosamples (transects 81, 101 and 108; Table 3); the average of these three values was 351 g (Table 3). The 90% LCB of the mean biomass estimate was 40,183 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on 27 of the 28 transects surveyed in the Subarea. All 26 transects surveyed had no *C. miniata* observed (Table 7). The mean density was therefore 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 12–18 and the 90% LCB of the density, the estimated population of *C. miniata* was 0 sea cucumbers.

All 27 transects surveyed had no *C. pallida* observed (Table 7). The mean density was therefore 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 12–18 and the 90% LCB of the density, the estimated population of *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 28 transects surveyed in Subarea 12–18 (except transect 112 for geoduck). No geoducks were seen on the 27 transects surveyed in the Subarea (Figure 31).

Red sea urchins were observed in higher numbers than green sea urchins in Subarea 12–18. 'Abundant' red sea urchin were seen on 8 (28%) transects, 'Many' were observed on 8 (28%) transects, 'Few' on 3 (11%) transects and zero on the remaining 9 (32%) transects (Figure 31). 'Abundant' green sea urchins were seen on 6 (21%) transects, 4 (14%) transects had 'Many', 5 (18%) transects had 'Few' and only 13 (46%) transects had no green sea urchin observed (Figure 31).

PFMA 12–19 (Area 12 Sointula)

Parastichopus californicus

PFMA 12–19 had consistently low *P. californicus* densities throughout (Figure 32). A total of 14 of the 16 transects surveyed had a density of less than 4.1 c/m-sh (Table 7). The highest density observed was 8.75 c/m-sh and the lowest 0.00 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 12–19 of 34,793 m; 5,740 of which is classified as Exposed and 29,053 m of which is classified as Protected by the BC Shorezone classification system.

Mean sea cucumber density was estimated to be 1.9 c/m-sh with a 90% LCB of 1.0 c/m-sh (Table 2). An average weight was calculated from the one biosample collected from transects 30; the mean weight was 205 g (Table 3). The 90% LCB of the mean biomass estimate was 6,118 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on all 16 transects surveyed in the Subarea. All 16 transects surveyed had no *C. miniata* observed (Table 7). The mean density was therefore 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 12–19 and the 90% LCB of the density, the estimated population of *C. miniata* was 0 sea cucumbers.

All 16 transects surveyed had no *C. pallida* observed (Table 7). The mean density was estimated to be 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 12–19 and the 90% LCB of the density, the estimated population of *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 16 transects surveyed in Subarea 12–19. No geoducks were observed on any of the 16 transects surveyed in the Subarea (Figure 33).

More red sea urchins than green sea urchins were observed in Subarea 12–19. 'Abundant' red sea urchins were seen on 3 (19%) transects, 'Many' on 1 (6%) transect, 'Few' on 1 (6%) transects and zero on the remaining 11 (69%) transects (Figure 33). 'Few' green sea urchins were seen on 4 (25%) transects and 12 (75%) transects had no green sea urchin observed (Figure 33).

PFMA 16–5 (Jervis Inlet Sechelt)

Parastichopus californicus

PFMA 16–5 had low *P. californicus* densities throughout the Subarea with four high density locations scattered in the northern part of the Subarea (Figure 34). A total of 9 of the 13 transects surveyed had a density less than 4.1 c/m-sh (Table 8). The highest density observed was 20.25 c/m-sh and the lowest 0.00 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 16–5 of 23,587 m of which 712 m is classified as Exposed and 22,875 m is classified as Protected by the BC Shorezone classification system.

Mean sea cucumber density was estimated to be 4.9 c/m-sh with a 90% LCB of 2.3 c/m-sh (Table 2). No biosample was collected in the Subarea, therefore following the methods described in Duprey et al. (2011) the lowest biosample weight in the Jervis Inlet Sechelt survey, 138 g, was used to calculate biomass. The 90% LCB of the mean biomass estimate was 7,506 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were only recorded on 6 of the 13 transects surveyed in the Subarea. All 6 transects surveyed had no *C. miniata* and no *C. pallida* observed (Table 8). Due to the low sample size no bootstrapping analysis was conducted; however due to the lack of any sightings of either species the estimated population size for both species is assumed to be 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all 13 transects surveyed in Subarea 16–5. A small number of geoducks were observed at the end of Porpoise Bay. 'Many' geoducks were seen on 1 (8%) transects, 'Few' were seen on 2 (15%) transects, and in the remaining 10 (77%) transects no geoducks were observed (Figure 35).

Green sea urchins were observed in small numbers in Subarea 16–5; no red sea urchins were observed in the Subarea (Figure 35). 'Many' green sea urchins were seen on 2 (15%) transects, and 11 (85%) transects had no green sea urchin observed (Figure 35).

PFMA 16–6 (Jervis Inlet Sechelt)

Parastichopus californicus

PFMA 16–6 had consistently high *P. californicus* densities throughout the Subarea (Figure 36). Only 2 of the 23 transects surveyed had a density less than 4.1 c/m-sh (Table 8). The highest density observed was 68.00 c/m-sh and the lowest 0.25 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 16–6 of 46,015 m, 426 m of which is classified as Exposed and 45,589 m of which is classified as Protected by the BC Shorezone classification system.

Mean sea cucumber density was estimated to be 17.9 c/m-sh with a 90% LCB of 13.0 c/m-sh (Table 2). An average weight was calculated from each of the two biosamples (transects 24 and 33; Table 3); the average of these two values was 176 g (Table 3). The 90% LCB of the mean biomass estimate was 104,495 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on 9 of the 23 transects surveyed in the Subarea. Five of the 23 transects surveyed had no *C. miniata* observed and the highest density observed was 5.0 c/m-sh (Table 8). The mean density was estimated to be 1.2 c/m-sh with a 90% LCB of 0.1 c/m-sh. Using the entire shoreline length of Subarea 16–6 and the 90% LCB of the density, the estimated population of *C. miniata* was 4,602 sea cucumbers.

Eight of the 23 transects surveyed had no *C. pallida* observed and the highest density observed was 0.5 c/m-sh (Table 8). The mean density was estimated to be 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 16–6 and the 90% LCB of the density, the estimated population of *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 23 transects surveyed in Subarea 16–6. Geoducks were rare in the Subarea. 'Few' geoducks were seen on 1 (4%) transects, and in the remaining 22 (96%) transects no geoducks were observed (Figure 37).

Green sea urchins were observed in small numbers in Subarea 16–6. No red sea urchins were seen on the 23 transects surveyed (Figure 37). 'Many' green sea urchins were seen on 1 (4%) transects, 1 (4%) transect had 'Few', and 21 (92%) transects had no green sea urchin observed (Figure 37).

PFMA 16–7 (Jervis Inlet Sechelt)

Parastichopus californicus

PFMA 16–7, Salmon Inlet, had low *P. californicus* densities, although numbers were stronger in the western half of the Subarea (Figure 38). A total of 17 of the 28 transects surveyed had a density of less than 4.1 c/m-sh (Table 8). The highest density observed was 15.00 c/m-sh and the lowest 0.00 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 16–7 of 43,932 m, 40,697 m classified as Protected and 3,235 m classified as Exposed by the BC Shorezone classification system.

Mean sea cucumber density was estimated to be 4.8 c/m-sh with a 90% LCB of 3.5 c/m-sh (Table 2). An average weight was calculated for each of the three biosamples (transects 42, 46 and 60; Table 3); the average of these three values was 153 g (Table 3). The 90% LCB of the mean biomass estimate was 23,031 Kg for Subarea 16–7 (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on 13 of the 28 transects surveyed in the Subarea. Ten of the 13 transects surveyed had no *C. miniata* observed and the highest density observed was 1.0 c/m-sh (Table 8). The mean density was estimated to be 0.2 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 16–7 and the 90% LCB of the density, the estimated population of *C. miniata* was 0 sea cucumbers.

All of the 13 transects surveyed had no *C. pallida* observed (Table 8). The mean density was therefore 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 16–7 and the 90% LCB of the density, the estimated population of *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 28 transects surveyed in Subarea 16–7. Geoducks were seen in low numbers in the Subarea. 'Many' geoducks were seen on 2 (7%) transects, 'Few' were seen on 1 (4%) transects, and 25 (89%) transects had no geoducks observed (Figure 39).

Green sea urchins were observed in small numbers in Subarea 16–7. No red sea urchins were seen on the 28 transects surveyed (Figure 39). 'Abundant' green sea urchins were seen on 3 (11%) transects, 2 (7%) transects had 'Many', 2 (7%) transects had 'Few' and 21 (75%) transects had no green sea urchin observed (Figure 39).

PFMA 16–8 (Jervis Inlet Sechelt)

Parastichopus californicus

PFMA 16–8 had consistently high *P. californicus* densities throughout the Subarea (Figure 40). A total of 7 of the 19 transects surveyed had a density of less than 4.1 c/m-sh (Table 8). The highest density observed was 30.50 c/m-sh and the lowest 0.00 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 16–8 of 32,374 m all classified as Protected by the BC Shorezone classification system.

Mean sea cucumber density was estimated to be 7.8 c/m-sh with a 90% LCB of 5.0 c/m-sh (Table 2). An average weight was calculated for each of the two biosamples (transects 66 and 72; Table 3); the average of these two values was 212 g (Table 3). The 90% LCB of the mean biomass estimate was 34,316 Kg for Subarea 16–8 (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on 13 of the 19 transects surveyed in the Subarea. Twelve of the 13 transects surveyed had no *C. miniata* observed and the highest density observed was 0.5 c/m-sh (Table 8). The mean density was estimated to be 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 16–8 and the 90% LCB of the density, the estimated population of *C. miniata* was 0 sea cucumbers.

All 13 transects surveyed had no *C. pallida* observed (Table 8). The mean density was therefore 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 16–8 and the 90% LCB of the density, the estimated population of *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 19 transects surveyed in Subarea 16–8. No geoducks or red sea urchins were observed in the Subarea (Figure 41). 'Few' green sea urchins were seen on 1 (5%) transects and 18 (95%) transects had no green sea urchin observed (Figure 41).

PFMA 16–9 (Jervis Inlet Sechelt)

Parastichopus californicus

PFMA 16–9 had consistently very high *P. californicus* densities throughout the Subarea, with low densities in the Skookumchuck narrows (Figure 42). A total of 2 of the 10 transects surveyed had a density of less than 4.1 c/m-sh (Table 8). The highest density observed was 98.50 c/m-sh and the lowest 0.00 c/m-sh.

A total of 5,779 m of shoreline was removed due to the Skookumchuck Narrows Provincial Park. No shoreline was removed due to logistical obstacles. The DFO management database has a total length for Subarea 16–9 of 21,235 m. The 15,456 m remaining, after the Provincial Park was removed, is classified as 652 m of Exposed shoreline and 14,809 m of Protected shoreline by the BC Shorezone classification system (Table 4).

Mean sea cucumber density was estimated to be 33.4 c/m-sh with a 90% LCB of 19.3 c/m-sh (Table 2). An average weight of 138 g was calculated from a singular biosample (transects 90; Table 3). The 90% LCB of the mean biomass estimate was 39,667 Kg for Subarea 16–9 (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were only recorded on 2 of the 10 transects surveyed in Subarea 16–9 (Table 8). Therefore no analysis on population size was conducted.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 10 transects surveyed in Subarea 16–9. No geoducks were observed in the Subarea (Figure 43).

Red sea urchins were observed in slightly smaller numbers than green sea urchins in Subarea 16–9. 'Abundant' red sea urchin were seen on 1 (10%) transects, 'Many' on 3 (30%) transects and zero on the remaining 6 (60%) transects (Figure 43). 'Abundant' green sea urchins were seen on 3 (30%) transects, 2 (20%) transects had 'Many', and 5 (50%) transects had no green sea urchin observed (Figure 43).

PFMA 16–10 (Jervis Inlet Sechelt)

Parastichopus californicus

PFMA 16–10 had relatively even distribution of low and high *P. californicus* densities throughout the Subarea (Figure 44). A total of 8 of the 22 transects surveyed had a density of less than 4.1 c/m-sh (Table 8). The highest density observed was 20.75 c/m-sh and the lowest was 0.5 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 16–10 of 36,204 m, 96 m of which is classified as Exposed and 36,108 m of which is classified as Protected by the BC Shorezone classification system (Table 4).

Mean sea cucumber density was estimated to be 9.3 c/m-sh with a 90% LCB of 7.2 c/m-sh (Table 2). An average weight was calculated from each of the two biosamples (transects 106 and 112; Table 3); the average of these two values was 172 g (Table 3). The 90% LCB of the mean biomass estimate was 44,716 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on 14 of the 22 transects surveyed in the Subarea. All 14 transects surveyed in Subarea 16–10 had no *C. miniata* or *C. pallida* observed (Table 8). The mean density was therefore 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 16–10 and the 90% LCB of the density, the estimated population of *C. miniata* and *C. pallida* was 0 individuals.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 22 transects surveyed in Subarea 16–10. No geoducks were observed in the Subarea (Figure 45).

Red sea urchins were observed in small numbers in Subarea 16–10. 'Few' red sea urchin were seen on 2 (9%) transects, and zero on the remaining 20 (91%) transects (Figure 45). Green sea urchins were seen in higher numbers than red sea urchin throughout the Subarea. 'Abundant' green sea urchins were seen on 2 (9%) transects, 5 (23%) transects had 'Few' and 15 (68%) transects had no green sea urchin observed (Figure 45).

PFMA 16–11 (Jervis Inlet Sechelt)

Parastichopus californicus

PFMA 16–11 had consistently high *P. californicus* densities on the northern side of Hardy Island, high densities were also seen westerly along Nelson Island (Figure 46). A total of 5 of the 22 transects surveyed had a density of less than 4.1 c/m-sh (Table 8). The highest density observed was 19.00 c/m-sh and the lowest was 0.00 c/m-sh.

A total of 5,779 m of shoreline was removed due to an Experimental Fishing Area located on the northern shore of the Subarea. No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 16–11 of 59,892 m; after removing the EFA shoreline 37,711 m remained, 1,081 m of which is classified as Exposed and 36,630 m of which is classified as Protected by the BC Shorezone classification system (Table 4).

Mean sea cucumber density was estimated to be 8.2 c/m-sh with a 90% LCB of 6.5 c/m-sh (Table 2). An average weight was calculated from each of the two biosamples (transects 118 and 130; Table 3); the average of these two values was 197 g (Table 3). The 90% LCB of the mean biomass estimate was 46,905 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on 10 of the 22 transects surveyed in the Subarea. Seven of the 10 transects surveyed had no *C. miniata* observed and the highest density observed was 1.5 c/m-sh (Table 8). The mean density

was estimated to be 0.3 c/m-sh with a 90% LCB of 0.1 c/m-sh. Using the entire shoreline length of Subarea 16–11 and the 90% LCB of the density, the estimated population of *C. miniata* was 5,990 sea cucumbers.

Seven of the 10 transects surveyed had no *C. pallida* observed and the highest density observed was 1.0 c/m-sh (Table 8). The mean density was estimated to be 0.3 c/m-sh with a 90% LCB of 0.1 c/m-sh. Using the entire shoreline length of Subarea 16–11 and the 90% LCB of the density, the estimated population of *C. pallida* was 5,990 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 22 transects surveyed in Subarea 16–11. Geoducks were not common in the Subarea. 'Few' geoducks were seen on 1 (5%) transects, in the remaining 21 (95%) transects no geoducks were observed (Figure 47).

No red sea urchins were observed in the Subarea 16–11 (Figure 47). Green sea urchins were seen in various relative abundances throughout the Subarea. 'Abundant' green sea urchins were seen on 1 (5%) transects, 3 (14%) transects had 'Many', 2 (9%) transects had 'Few' and 16 (73%) transects had no green sea urchin observed (Figure 47).

PFMA 16–12 (Jervis Inlet Sechelt)

Parastichopus californicus

PFMA 16–12 had high *P. californicus* densities along the eastern side of Hotham Sound especially south of Syren Point (Figure 48). A total of 11 of the 29 transects surveyed had a density of less than 4.1 c/m-sh (Table 8). The highest density observed was 24.00 c/m-sh and the lowest 0.0 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 16–12 of 53,525 m all classified as Protected by the BC Shorezone classification system (Table 4).

Mean sea cucumber density was estimated to be 7.1 c/m-sh with a 90% LCB of 5.3 c/m-sh (Table 2). An average weight was calculated from each of the three biosamples (transects 66 and 72; Table 3); the average of these three values was 200 g (Table 3). The 90% LCB of the mean biomass estimate was 56,737 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on 13 of the 29 transects surveyed in the Subarea. Nine of the 13 transects surveyed had no *C. miniata* observed and the highest density observed was 1.5 c/m-sh (Table 8). The mean density was estimated to be 0.3 c/m-sh with a 90% LCB of 0.1 c/m-sh. Using the entire shoreline length of Subarea 16–12 and the 90% LCB of the density, the estimated population of *C. miniata* was 5,353 sea cucumbers.

Six of the 13 transects surveyed had no *C. pallida* observed and the highest density observed was 10.5 c/m-sh (Table 8). The mean density was estimated to be 1.4 c/m-sh with a 90% LCB of 0.5 c/m-sh. Using the entire shoreline length of Subarea 16–12 and the 90% LCB of the density, the estimated population of *C. pallida* was 26,763 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 29 transects surveyed in Subarea 16–12. Geoducks were not common in the Subarea. 'Many' Geoducks were seen on 2 (7%) transects, in the remaining 27 (93%) transects no geoducks were observed (Figure 49).

No red sea urchins were observed in Subarea 16–12 (Figure 49). 'Many' green sea urchins were seen on 2 (7%) transects, 3 (10%) transects had 'Few' and 24 (83%) transects had no green sea urchin observed (Figure 49).

PFMA 16–13 (Jervis Inlet Sechelt)

Parastichopus californicus

PFMA 16–13, Prince of Wales Reach, had low and high *P. californicus* densities spread throughout the Subarea; densities appear to be higher on the eastern side of the reach compared to the western side (Figure 50). A total of 20 of the 44 transects surveyed had a density of less than 4.1 c/m-sh (Table 8). The highest density observed was 26.50 c/m-sh and the lowest was 0.00 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 16–13 of 79,464 m, 6,180 m of which is Exposed and 73,284 m is classified as Protected by the BC Shorezone classification system (Table 4).

Mean sea cucumber density was estimated to be 7.0 c/m-sh with a 90% LCB of 5.4 c/m-sh (Table 2). An average weight was calculated from each of the four biosamples (transects 171, 181, 194 and 202; Table 3); the average of these four values was 188 g (Table 3). The 90% LCB of the mean biomass estimate was 74,398 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on 28 of the 44 transects surveyed in the Subarea. Twenty-five of the 28 transects surveyed had no *C. miniata* observed and the highest density observed was 3.0 c/m-sh (Table 8). The mean density was estimated to be 0.1 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 16–13 and the 90% LCB of the density, the estimated population of *C. miniata* was 0 sea cucumbers.

Twenty-two of the 28 transects surveyed had no *C. pallida* observed and the highest density observed was 3.5 c/m-sh (Table 8). The mean density was estimated to be 0.3 c/m-sh with a 90% LCB of 0.1 c/m-sh. Using the entire shoreline length of Subarea 16–

13 and the 90% LCB of the density, the estimated population of *C. pallida* was 7,947 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 44 transects surveyed in Subarea 16–13. No geoducks were seen in the Subarea (Figure 51).

Red sea urchins were observed in small numbers in Subarea 16–13. 'Few' red sea urchin were seen on 2 (5%) transects, and zero on the remaining 42 (95%) transects (Figure 51). Green sea urchins were seen in higher numbers than red sea urchin throughout the Subarea. 'Many' green sea urchins were seen on 3 (7%) transects, 7 (16%) transects had 'Few', and 34 (77%) transects had no green sea urchin observed (Figure 51).

PFMA 16–14 (Jervis Inlet Sechelt)

Parastichopus californicus

PFMA 16–14 had high *P. californicus* densities spread throughout the Subarea (Figure 52). A total of 7 of the 19 transects surveyed had a density of less than 4.1 c/m-sh (Table 8). The highest density observed was 17.50 c/m-sh and the lowest 0.00 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 16–14 of 27,804 m all classified as Protected by the BC Shorezone classification system (Table 4).

Mean sea cucumber density was estimated to be 6.4 c/m-sh with a 90% LCB of 4.5 c/m-sh (Table 2). An average weight was calculated from each of the two biosamples (transects 218 and 225; Table 3); the average of these two values was 152 g (Table 3). The 90% LCB of the mean biomass estimate was 19,018 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were only recorded on 7 of the 19 transects surveyed in Subarea 16–14 (Table 8). Therefore no analysis on population size was conducted.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on 18 of the 19 transects surveyed in Subarea 16–14. Geoducks were not common in the Subarea. 'Few' geoducks were seen on 1 (6%) transect, in the remaining 17 (94%) transects no geoducks were observed (Figure 53).

No red sea urchins were observed in Subarea 16–14 (Figure 53). Green sea urchins were not common in the Subarea. 'Many' green sea urchins were seen on 1 (6%) transect, and 17 (94%) transects had no green sea urchin observed (Figure 53).

PFMA 16–15 (Jervis Inlet Sechelt)

Parastichopus californicus

PFMA 16–15 had consistently low *P. californicus* densities throughout Queens Reach and Princess Lousia Inlet (Figure 54). A total of 26 of the 32 transects surveyed had a density of less than 4.1 c/m-sh (Table 8). The highest density observed was 10.50 c/m-sh and the lowest 0.00 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 16–15 of 61,864 m, of which 31 m is classified as Exposed and 61,843 m is classified as Protected by the BC Shorezone classification system (Table 4).

Mean sea cucumber density was estimated to be 2.3 c/m-sh with a 90% LCB of 1.7 c/m-sh (Table 2). An average weight of 181 g was calculated from a singular biosample (transects 234; Table 3). The 90% LCB of the mean biomass estimate was 19,029 Kg for Subarea 16–15 (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on 17 of the 32 transects surveyed in the Subarea. All 17 transects surveyed had no *C. miniata* observed (Table 8). The mean density was therefore 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 16–15 and the 90% LCB of the density, the estimated population of *C. miniata* was 0 sea cucumbers.

Sixteen of the 17 transects surveyed had no *C. pallida* observed and the highest density observed was 0.5 c/m-sh (Table 8). The mean density was estimated to be 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 16–15 and the 90% LCB of the density, the estimated population of *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 32 transects surveyed in Subarea 16–15. Geoducks were common in the Subarea. 'Many' geoducks were seen on 1 (3%) transect, and on the remaining 31 (97%) transects no geoducks were observed (Figure 55).

Red sea urchins were not common in Subarea 16–15. 'Few' red sea urchin were seen on 2 (6%) transects, and zero on the remaining 30 (94%) transects (Figure 55). Green sea urchins were seen in lower numbers than red sea urchin in the Subarea. 'Few' green sea urchins were seen on 1 (3%) transect, and the remaining 31 (97%) transects had no green sea urchin observed (Figure 55).

PFMA 18–1 (A18 South Gulf Islands)

Parastichopus californicus

PFMA 18–1, the east side of Mayne and Samuel Islands, had high *P. californicus* densities spread throughout the Subarea (Figure 56). A total of 4 of the 13 transects

surveyed had a density of less than 4.1 c/m-sh (Table 9). The highest density observed was 51.50 c/m-sh and the lowest 0.00 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 18–1 of 26,712 m, of which all is classified as Protected by the BC Shorezone classification system (Table 4).

Mean sea cucumber density was estimated to be 17.8 c/m-sh with a 90% LCB of 11.3 c/m-sh (Table 2). No biosample was collected in the Subarea. Therefore, following the methods described in Duprey et al. (2011), the lowest biosample weight of 142 g from the A18 South Gulf Islands survey, was used to calculate biomass (Table 3). The 90% LCB of the mean biomass estimate was 42,862 Kg for Subarea 18–1 (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on 9 of the 13 transects surveyed in the Subarea. Seven of the 9 transects surveyed had no *C. miniata* observed and the highest density observed was 7.0 c/m-sh (Table 9). The mean density was estimated to be 1.1 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 18–1 and the 90% LCB of the density, the estimated population of *C. miniata* was 0 sea cucumbers.

All of the 13 transects surveyed had no *C. pallida* observed (Table 9). The mean density was therefore 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 18–1 and the 90% LCB of the density, the estimated population of *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on the 13 transects surveyed in Subarea 18–1. Geoducks were seen in small numbers in the Subarea (Figure 57). 'Many' geoducks were seen on 1 (8%) transect, and on the remaining 12 (92%) transects no geoducks were seen.

Red sea urchins were observed throughout Subarea 18–1. 'Abundant' red sea urchin were seen on 4 (31%) transects, 'Many' on 4 (31%) transects, and zero on the remaining 5 (38%) transects (Figure 57). Green sea urchins were seen in lower numbers compared to red sea urchin in the Subarea. 'Abundant' green sea urchins were seen on 3 (23%) transects, 1 (8%) transects had 'Many', 3 (23%) transects had 'Few', and on 6 (46%) of the transects no green sea urchin were observed (Figure 57).

PFMA 18–2 & 9 (A18 South Gulf Islands)

Parastichopus californicus

PFMA 18–2 & 9, including Active Pass, had high *P. californicus* densities mixed in with low density areas both in the Pass and the northern side of Provost Island (Figure 58). A total of 8 of the 16 transects surveyed had a density of less than 4.1 c/m-sh (Table 9). The highest density observed was 46.00 c/m-sh and the lowest 0.00 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length of 29,753 m for Subarea 18–2 and 1,663 m for Subarea 18–9, all of which is classified as Protected by the BC Shorezone classification system (Table 4).

Mean sea cucumber density in the Analysis Area was estimated to be 9.8 c/m-sh with a 90% LCB of 5.7 c/m-sh (Table 2). In Subarea 18–2 an average weight was calculated from the single biosample (transect 21; Table 3); the average of was 142 g (Table 3). No biosample was collected in Subarea 18–9, therefore following the methods prescribed in Duprey et al. (2011), the lowest biosample weight in the A18 South Gulf Islands survey of 142 g, was used to calculate biomass (Table 3). The 90% LCB of the mean biomass estimate was 24,082 Kg for Subarea 18–2 and 1,346 Kg for Subarea 18–9 (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on 11 of the 16 transects surveyed in the Subarea. Five of the 11 transects surveyed had no *C. miniata* observed and the highest density observed was 19.5 c/m-sh (Table 9). The mean density was estimated to be 2.4 c/m-sh with a 90% LCB of 0.6 c/m-sh. Using the entire shoreline length of Subarea 18–2 and 18–9 along with the 90% LCB of the density, the estimated population of *C. miniata* was 18,850 sea cucumbers.

Ten of the 11 transects surveyed had no *C. pallida* observed; the only density observed was 0.5 c/m-sh (Table 9). The mean density was estimated to be 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 18–2 and 18–9 along with the 90% LCB of the density, the estimated population of *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 16 transects surveyed in Subarea 18–2 and 18–9. Geoducks were seen in small numbers in the Analysis Area. 'Many' geoducks were seen on 1 (6%) transect, 'Few' on 1 (6%) transect and none were observed on the remaining 14 (88%) transects (Figure 59).

Red sea urchins were observed in high numbers in the Analysis Area, especially in Active Pass. 'Abundant' red sea urchins were seen on 6 (38%) transects, 'Many' on 3 (19%) transects and zero on the remaining 7 (44%) transects (Figure 59). Green sea urchins were seen in lower numbers than red sea urchin throughout the Analysis Area. 'Abundant' green sea urchins were seen on 2 (12%) transects, 'Many' were seen on 1 (6%) transect, 3 (19%) transects had 'Few', and 10 (63%) transects had no green sea urchin observed (Figure 59).

PFMA 18–3 (A18 South Gulf Islands)

Parastichopus californicus

PFMA 18–3 had low *P. californicus* densities throughout the Subarea; densities appear to be lowest in Ganges and Long Harbour (Figure 60). A total of 18 of the 25

transects surveyed had a density of less than 4.1 c/m-sh (Table 9). The highest density observed was 14.25 c/m-sh and the lowest 0.00 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 18–3 of 63,034 m, all of which is classified as Protected by the BC Shorezone classification system (Table 4).

Mean sea cucumber density was estimated to be 1.2 c/m-sh with a 90% LCB of 0.4 c/m-sh (Table 2). No biosample was collected in the Subarea, therefore following the methods prescribed in Duprey et al. (2011) the lowest biosample weight in the A18 South Gulf Islands survey, 142 g, was used to calculate biomass (Table 3). The 90% LCB of the mean biomass estimate was 3,580 Kg for Subarea 18–3 (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on 19 of the 25 transects surveyed in the Subarea. Eighteen of the 25 transects surveyed had no *C. miniata* observed and the only density observed was 3.5 c/m-sh (Table 9). The mean density was estimated to be 0.2 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 18–3 and the 90% LCB of the density, the estimated population of *C. miniata* was 0 sea cucumbers.

All of the 19 transects surveyed had no *C. pallida* observed (Table 9). The mean density was therefore 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 18–3 and the 90% LCB of the density, the estimated population of *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 25 transects surveyed in Subarea 18–3. Geoducks were seen in small numbers in the Subarea. 'Few' geoducks were seen on 2 (8%) transects and none were observed on the remaining 23 (92%) transects (Figure 61).

Red sea urchins were observed in small numbers in Subarea 18–3. 'Abundant' red sea urchins were seen on 2 (8%) transects, 'Few' were seen on 1 (4%) transect and zero on the remaining 22 (88%) transects (Figure 61). Green sea urchins were seen in lower numbers than red sea urchin throughout the Subarea. 'Many' green sea urchins were seen on 1 (4%) transect, and 24 (96%) transects had no green sea urchin observed (Figure 61).

PFMA 18–4 (A18 South Gulf Islands)

Parastichopus californicus

PFMA 18–4 had high *P. californicus* densities along the west side of North Pender Island and the north side of Moresby Island (Figure 62). A total of 13 of the 25 transects surveyed had a density of less than 4.1 c/m-sh (Table 9). The highest density observed was 23.75 c/m-sh and the lowest 0.00 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 18–4 of 49,106 m, all of which is classified as Protected by the BC Shorezone classification system (Table 4).

Mean sea cucumber density was estimated to be 6.0 c/m-sh with a 90% LCB of 3.7 c/m-sh (Table 2). An average weight was calculated from each of the three biosamples (transects 64, 73, and 81; Table 3); the average of these three values was 191 g (Table 3). The 90% LCB of the mean biomass estimate was 34,703 Kg for Subarea 18–4 (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on 18 of the 25 transects surveyed in the Subarea. Thirteen of the 18 transects surveyed had no *C. miniata* observed and the highest density observed was 3.5 c/m-sh (Table 9). The mean density was estimated to be 0.5 c/m-sh with a 90% LCB of 0.2 c/m-sh. Using the entire shoreline length of Subarea 18–4 and the 90% LCB of the density, the estimated population of *C. miniata* was 9,821 sea cucumbers.

All of the 18 transects surveyed had no *C. pallida* observed (Table 9). The mean density was therefore 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 18–4 and the 90% LCB of the density, the estimated population of *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 25 transects surveyed in Subarea 18–2. No geoducks were seen in the Subarea (Figure 63).

Red sea urchins were observed in high numbers along the south end of North Pender Island and Moresby Island. 'Abundant' red sea urchin were seen on 5 (20%) transects, 'Many' on 5 (20%) transects. 'Few' on 2 (8%) transects and zero on the remaining 13 (52%) transects (Figure 63). Green sea urchins were seen in much lower numbers than red sea urchin throughout the Subarea. 'Abundant' green sea urchins were seen on 1 (4%) transect, 'Many' were seen on 1 (4%) transect, 'Few' were seen on 3 (12%) transects and 20 (80%) transects had no green sea urchin observed (Figure 63).

PFMA 18–5 (A18 South Gulf Islands)

Parastichopus californicus

PFMA 18–5 had low *P. californicus* densities spread along the east side of North and South Pender Island (Figure 64). A total of 28 of the 42 transects surveyed had a density of less than 4.1 c/m-sh (Table 9). The highest density observed was 40.75 c/m-sh and the lowest 0.00 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 18–5 of 82,606 m, all of which is classified as Protected by the BC Shorezone classification system (Table 4).

Mean sea cucumber density was estimated to be 5.3 c/m-sh with a 90% LCB of 3.4 c/m-sh (Table 2). An average weight was calculated from each of the four biosamples (transects 88, 102, 111 and 113; Table 3); the average of these four values was 240 g (Table 3). The 90% LCB of the mean biomass estimate was 67,406 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on 19 of the 42 transects surveyed in the Subarea. Twelve of the 19 transects surveyed had no *C. miniata* observed and the highest density observed was 4.0 c/m-sh (Table 9). The mean density was estimated to be 0.4 c/m-sh with a 90% LCB of 0.2 c/m-sh. Using the entire shoreline length of Subarea 18–5 and the 90% LCB of the density, the estimated population of *C. miniata* was 16,521 sea cucumbers.

Eighteen of the 19 transects surveyed had no *C. pallida* observed and the only density observed was 0.5 c/m-sh (Table 9). The mean density was estimated to be 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 18–5 and the 90% LCB of the density, the estimated population of *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on 41 of the 42 transects surveyed in Subarea 18–5. Geoducks were seen in small numbers in the Subarea. 'Many' geoducks were seen on 1 (2%) transect, 'Few' were seen on 3 (7%) transects and none were observed on the remaining 37 (90%) transects (Figure 65).

Red sea urchins were observed in larger numbers than green sea urchins in Subarea 18–5. 'Abundant' red sea urchin were seen on 5 (12%) transects, 'Many' were seen on 7 (17%) transects, 'Few' on 1 (2%) transect and zero on the remaining 28 (68%) transects (Figure 65). 'Abundant' green sea urchins were seen on 1 (2%) transect, 'Many' were seen on 1 (2%) transect, 'Few' were seen on 2 (5%) transects, and 37 (90%) transects had no green sea urchin observed (Figure 65).

PFMA 18–6 (A18 South Gulf Islands)

Parastichopus californicus

PFMA 18–6 had low *P. californicus* densities around Swartz Bay and a higher range of densities throughout the rest of the Subarea (Figure 66). A total of 22 of the 32 transects surveyed had a density of less than 4.1 c/m-sh (Table 9). The highest density observed was 64.25 c/m-sh and the lowest 0.00 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 18–6 of 57,103 m, all of which is classified as Protected by the BC Shorezone classification system (Table 4).

Mean sea cucumber density was estimated to be 4.9 c/m-sh with a 90% LCB of 2.5 c/m-sh (Table 2). An average weight was calculated from each of the three biosamples (transects 125, 151, and 154; Table 3); the average of these three values was 233 g (Table 3). The 90% LCB of the mean biomass estimate was 33,262 Kg (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were only recorded on 5 of the 32 transects surveyed in the Subarea therefore no analysis was completed for either species.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 32 transects surveyed in Subarea 18–6. Geoducks were seen in small numbers in the Subarea. 'Few' were seen on 5 (16%) transects and none were observed on the remaining 27 (84%) transects (Figure 67).

Red sea urchins were observed in higher numbers than green sea urchins in Subarea 18–6. 'Abundant' red sea urchin were seen on 4 (13%) transects, 'Many' were seen on 2 (6%) transects, 'Few' were seen on 7 (22%) transects and zero on the remaining 19 (59%) transects (Figure 67). 'Many' green sea urchins were seen on 1 (3%) transects, 3 (9%) transects had 'Few', and 28 (88%) transects had no green sea urchin observed (Figure 67).

PFMA 18–10 (A18 South Gulf Islands)

Parastichopus californicus

PFMA 18–10 had low *P. californicus* densities spread throughout the Subarea (Figure 68). All 9 transects surveyed had a density of less than 4.1 c/m-sh (Table 9). The highest density observed was 2.00 c/m-sh and the lowest 0.00 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 18–10 of 16,598 m, all of which is classified as Protected by the BC Shorezone classification system (Table 4).

Mean sea cucumber density was estimated to be 0.5 c/m-sh with a 90% LCB of 0.1 c/m-sh (Table 2). An average weight was calculated from the single biosample (transects 159; Table 3); the average values was 298 g (Table 3). The 90% LCB of the mean biomass estimate was 495 Kg for Subarea 18–10 (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were recorded on all 9 transects surveyed in the Subarea. Seven of the 9 transects surveyed had no *C. miniata* observed and the highest density observed was 1.5 c/m-sh (Table 9). The mean density was estimated to be 0.3 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 18–10 and the 90% LCB of the density, the estimated population of *C. miniata* was 0 sea cucumbers.

All 9 transects surveyed had no *C. pallida* observed (Table 9). The mean density was therefore 0.0 c/m-sh with a 90% LCB of 0.0 c/m-sh. Using the entire shoreline length of Subarea 18–10 and the 90% LCB of the density, the estimated population of *C. pallida* was 0 sea cucumbers.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 9 transects surveyed in Subarea 18–10. Geoducks were seen in small numbers in the Subarea. 'Few' were seen on 1 (11%) transects and none were observed on the remaining 8 (88%) transects (Figure 69).

No red sea urchins or green sea urchins were observed in Subarea 18–10 (Figure 69).

PFMA 18–11 (A18 South Gulf Islands)

Parastichopus californicus

PFMA 18–11 had either low or high *P. californicus* densities sites with very few densities in-between (Figure 70, Table 9). A total of 6 of the 13 transects surveyed had a density of less than 4.1 c/m-sh (Table 9). The highest density observed was 22.75 c/m-sh and the lowest 0.00 c/m-sh.

No shoreline segments were removed due to logistical obstacles or other closures. The DFO management database has a total length for Subarea 18–11 of 25,116 m, 2,866 m of which is Exposed and 22,250 m is classified as Protected by the BC Shorezone classification system (Table 4).

Mean sea cucumber density was estimated to be 8.7 c/m-sh with a 90% LCB of 4.7 c/m-sh (Table 2). No biosample was collected in Subarea 18–11, therefore following the methods prescribed in Duprey et al. (2011) the lowest biosample weight in the A18 South Gulf Islands survey, 142 g, was used to calculate biomass (Table 3). The 90% LCB of the mean biomass estimate was 15,867 Kg for Subarea 18–11 (Table 4).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* numbers were not recorded on any of the transects surveyed in this Subarea; therefore no analysis could be completed.

Geoduck, red sea urchin and green sea urchin abundance

Relative abundance data were collected on all of the 13 transects surveyed in Subarea 18–11. No geoducks were seen in the Subarea (Figure 71).

Red sea urchins were observed in higher numbers than green sea urchins in Subarea 18–11. 'Abundant' red sea urchin were seen on 4 (31%) transects, 'Few' were seen on 2 (15%) transects and zero on the remaining 7 (54%) transects (Figure 71). 'Abundant' green sea urchins were seen on 2 (15%) transect, 'Many' were seen on 1 (8%) transect, 2 (15%) transects had 'Few', and 8 (62%) transects had no green sea urchin observed (Figure 71).

PERMANENT BIO-TRANSECTS

Kildidt Sound

Parastichopus californicus

Nineteen permanent BioTransects were originally planned to be established randomly throughout Kildidt Sound, Subareas 7–27 and 28. However, seven of the transects had no sea cucumbers and no permanent transects were established at these sites. The remaining twelve permanent BioTransects were established and surveyed. The number of *P. californicus* collected from each BioTransect ranged from 1 (transect 17) to 49 (transect 115). Transect 17 was eliminated from mean weight calculations as the only sea cucumber collected on the transect weighed 32 g and was most likely a juvenile; juveniles are not included in biomass calculations. Each of the remaining permanent BioTransects was averaged and a mean weight for each Subarea was estimated as the mean of the BioTransect averages (Duprey et al. 2011). Subarea 7–27's mean weight was 308 g and Subarea 7–28's mean weight was 309 (Table 3).

Cucumaria miniata and *C. pallida*

Cucumaria miniata and *C. pallida* are not recorded while collecting permanent bio-transect data.

Geoduck, red sea urchin and green sea urchin abundance

Geoduck, red sea urchin and green sea urchin relative abundance is not recorded while collecting permanent bio-transects.

DISCUSSION

Results of the surveys presented in this report are discussed in relation to policy recommendations in the sea cucumber assessment framework (Duprey et al. 2011). The recommendations that are specific to biomass estimation include a minimum density threshold for opening to commercial harvest of 2.5 c/m-sh, and use of the 90% LCB of the estimated mean density and the mean weight estimates for biomass estimation.

Area 3 North

The density estimates of *P. californicus* for Area 3 North were low and all but one PFM Subarea had 90% LCBs that were lower than 2.5 c/m-sh. The only Subarea in the Area 3 North survey that achieves the minimum threshold for opening is Subarea 3–11.

A no-take reserve was established in the Nasoga Gulf, Subarea 3–9, after completion of the Area 3 South survey (Duprey 2011). This is an ideal location for a reserve in PFMA 3 as it is in a central location and is easily delineated and defined. Also, as most of the surveyed areas in Area 3 North have low densities and are not suitable for commercial re-opening, they would not make appropriate no-take reserves. Therefore, no new no-take reserve locations have been identified as a result of the Area 3 North survey.

Princess Royal Channel

The density estimates of *P. californicus* for Princess Royal Channel were high, with all surveyed PFM Subareas having 90% LCBs greater than 2.5 c/m-sh. All Subareas in the Princess Royal Channel survey thus meet the criteria for re-opening (Duprey et al. 2011). The four inlets branching eastward off of Princess Royal Channel had lower densities than the channel itself, but still ranged from 3.4 to 7.4 c/m-sh.

Subarea 6–23, Khutze Inlet, is considered to be an ideal location for a no-take reserve. The Subarea has representative *P. californicus* densities and can be easily distinguished geographically. *C. miniata* were also observed in good numbers, and there were small numbers of *C. pallida*. High numbers of Dungeness crab (*Cancer magister*) and squat lobster (*Munida quadrispina*) were seen in the Subarea; red and green sea urchins are also present and red king crabs (*Paralithodes camtschaticus*) were observed at the head of the inlet. This area appears to support a wide variety of marine life and would make a good candidate for a multi-species reserve.

Area 12 Sointula

The survey results for Area 12 Sointula indicate marginal densities, overall. Only three of the six Subareas meet the minimum density threshold for re-opening; Subareas 12–3, 12–4 and 12–21.

A no-take reserve at the western edge of PFM Subarea 12–6 that was established after the 2009 Area 12 survey remains in place and no further reserve area has been identified from the Sointula survey. The 12–6 reserve includes 177.2 km of shoreline which is good sea cucumber habitat with high densities of *P. californicus*, and is well located to provide a source of recruitment to surrounding areas.

Jervis Inlet – Sechelt

The density estimates of *P. californicus* for the Jervis Inlet – Sechelt Open survey were high, with 9 of the 11 surveyed Subareas having 90% LCBs higher than 2.5 c/m-sh. PFM Subareas 16–5 and 16–15 had densities below 2.5 c/m-sh, while Subareas 16–6 through to 16–14 have sufficient densities to be re-opened to commercial harvest.

PFM Subarea 16–14, the section of Princess Royal Reach north of Glacial Creek to Patrick Point, has been identified as a good candidate for a no-take reserve. The Subarea has representative *P. californicus* densities and can easily be distinguished geographically. Densities of *C. miniata* and *C. pallida* were not recorded on enough transects to provide any insight into their populations in the Subarea. No red sea urchins were observed in the area and there were only a couple of sightings of green sea urchins and geoducks; however this is consistent with the relative abundance that occurred elsewhere in the Jervis Inlet – Sechelt area.

A18 South Gulf Islands

The density estimates for Area 18 South Gulf Islands has sufficient densities for a commercial fishery except for the two main harbours on Saltspring Island, Ganges (Subarea 18–3) and Fulford Harbour (Subarea 18–10), which had negligible populations of *P. californicus*. PFM Subareas 18–1, 18–2, 18–4 to 18–6, 18–9 and 18–11 met or exceeded the minimum density threshold for recommending re-opening.

PFM Subarea 18–6, the Moresby Passage and Colburne Passage area, is identified as a good candidate for a new no-take reserve. The Subarea has slightly lower sea cucumber densities than several of the other Subareas in the survey, but its central location makes it a better option for a reserve than others. Densities of *C. miniata* and *C. pallida* were not recorded on enough transects to provide any insight into their populations in the Subarea. There were sightings of red sea urchins and geoducks in the Subarea with some sightings of green sea urchins. Subareas 18–7 and 18–8 are currently closed to harvest, however if future surveys in these two Subareas find healthy populations of *P. californicus,* then the no-take reserve could be moved to Subarea 18–7 and 18–8.

Kildidt Sound

The mean weight estimates from the Kildidt Sound permanent BioTransects were high. According to the sea cucumber stock assessment framework (Duprey et al. 2011), the first choice for the source of mean weight estimates is biosample data and thus, the mean weights presented here should replace the existing weight estimates used to calculate biomass for PFM Subareas 7–27 and 7–28. There were many permanent BioTransect locations with no sea cucumbers observed. This may indicate a high degree of patchiness in sea cucumber density in these Subareas and a survey of the area should be conducted; currently, a regional baseline density of 6.00 c/m-sh is being used for both Subareas.

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Table 1. Number and ID of transects surveyed, and number of *Parastichopus californicus* biosamples collected in Open surveys conducted June 2010 – May 2011, by PFM Subarea. The total shoreline length is measured from the cucland.shp dataset using ArcGIS 9.3. (Note this is different from the shoreline length used for biomass calculations, which was measured using Compugrid.)

Analysis Areas	Survey	PFMA Subareas	Shoreline Length (Km)	Number (and ID) of Transects	Biomsamples
1	Area 3 North	3–11	86.0	34 (TR 1–43)	4
2	Area 3 North	3–12	62.8	24 (TR 44–76)	0
3	Area 3 North	3–13	34.4	12 (TR 77–92)	2
4	Area 3 North	3–14	51.0	23 (TR 93–231)	1
5	Area 3 North	3–15	69.6	35 (TR 232–266)	2
6	Area 3 North	3–16	24.7	10 (TR 267–279)	0
7	Area 3 North	3–17	23.0	12 (TR 280–291)	1
8	Princess Royal Channel	6–20	126.0	63 (TR 1–63)	6
9	Princess Royal Channel	6–21	18.8	10 (TR 64–73)	1
10	Princess Royal Channel	6–22	18.4	10 (TR 74–83)	1
11	Princess Royal Channel	6–23	27.9	13 (TR 84–96)	1
12	Princess Royal Channel	6–24	20.0	10 (TR 97–106)	1
	Area 12 Sointula	12–3	83.1	41 (TR 10–51)	4
13	Area 12 Sointula	12–4	16.2	6 (TR 1–9)	0
	Area 12 Sointula	12–21	7.6	4 (TR 52–55)	0
14	Area 12 Sointula	12–5	57.1	19 (TR 114–141)	2
15	Area 12 Sointula	12–18	76.8	28 (TR 75–113)	3
16	Area 12 Sointula	12–19	37.5	16 (TR 56–74)	1
17	Jervis Inlet Sechelt	16–5	25.7	13 (TR 1–13)	0
18	Jervis Inlet Sechelt	16–6	45.3	23 (TR 14–36)	2
19	Jervis Inlet Sechelt	16–7	55.3	28 (TR 37–64)	3
20	Jervis Inlet Sechelt	16–8	39.2	19 (TR 65–84)	2
21	Jervis Inlet Sechelt	16–9	21.4	10 (TR 85–95)	1
22	Jervis Inlet Sechelt	16–10	42.8	22 (TR 96–117)	2
23	Jervis Inlet Sechelt	16–11	43.9	22 (TR 118–139)	2
24	Jervis Inlet Sechelt	16–12	58.2	29 (TR 140–168)	3
25	Jervis Inlet Sechelt	16–13	88.0	44 (TR 169–212)	4
26	Jervis Inlet Sechelt	16–14	36.8	19 (TR 213–231)	2
27	Jervis Inlet Sechelt	16–15	63.3	32 (TR 232–263)	1
28	A18 South Gulf Islands	18–1	25.6	13 (TR 1–13)	0
29	A18 South Gulf Islands	18–2	30.7	15 (TR 14–28)	1
	A18 South Gulf Islands	18–9	1.7	1 (TR 157)	0
30	A18 South Gulf Islands	18–3	57.0	25 (TR 29–56)	0
31	A18 South Gulf Islands	18–4	49.2	25 (TR 57–81)	3
32	A18 South Gulf Islands	18–5	85.8	42 (TR 82–124)	4
33	A18 South Gulf Islands	18–6	62.3	32 (TR 125–156)	3
34	A18 South Gulf Islands	18–10	16.9	9 (TR 158–166)	1
35	A18 South Gulf Islands	18–11	26.8	13 (TR 167–179)	0
	Total	**38**	**1716.8**	**806**	**64**

Table 2. Mean linear *Parastichopus californicus* density estimates by PFM Subarea, with lower (LCB) and upper (UCB) confidence bounds (sea cucumbers per metre of shoreline: c/m-sh) from Open surveys completed June 2010 – May 2011. Each PFM Subarea was analyzed separately except those shown with * or ** which indicates that the transects were pooled into Analysis Areas.

PFMA Subarea	Survey	No. Transects	Mean	Confidence Level	LCB	UCB
3–11	Area 3 North	34	9.5	99	6.5	15.5
				95	7.2	13.1
				90	7.5	12.4
				75	8.1	11.6
3–12	Area 3 North	24	2.0	99	0.8	4.0
				95	1.0	3.4
				90	1.1	3.2
				75	1.3	2.8
3–13	Area 3 North	12	3.3	99	2.1	5.6
				95	2.3	5.0
				90	2.4	4.7
				75	2.7	4.3
3–14	Area 3 North	23	0.5	99	0.1	1.8
				95	0.2	1.4
				90	0.2	1.2
				75	0.3	1.0
3–15	Area 3 North	35	1.0	99	0.5	1.9
				95	0.6	1.6
				90	0.7	1.5
				75	0.8	1.3
3–16	Area 3 North	10	0.0	99	0.0	0.0
				95	0.0	0.0
				90	0.0	0.0
				75	0.0	0.0
3–17	Area 3 North	12	2.7	99	0.4	7.7
				95	0.7	6.7
				90	1.0	5.8
				75	1.4	4.8
6–20	Princess Royal Channel	63	13.8	99	10.7	18.4
				95	11.3	16.9
				90	11.7	16.4
				75	12.2	15.5
6–21	Princess Royal Channel	10	8.3	99	3.2	21.6
				95	3.8	19.7
				90	4.2	18.4
				75	5.0	14.8
6–22	Princess Royal Channel	10	11.4	99	6.0	23.7
				95	6.8	19.3
				90	7.4	17.8
				75	8.6	15.6

Table 2, cont'd.

PFMA Subarea	Survey	No. Transects	Mean	Confidence Level	LCB	UCB
6–23	Princess Royal Channel	13	5.5	99	2.8	12.5
				95	3.2	10.1
				90	3.4	9.3
				75	4.0	8.2
6–24	Princess Royal Channel	10	9.8	99	6.5	14.2
				95	7.1	13.5
				90	7.5	12.9
				75	8.1	12.0
12–3*	Area 12 Sointula	51	4.3	99	3.3	5.7
				95	3.5	5.5
				90	3.6	5.2
				75	3.8	4.9
12–4*	Area 12 Sointula	51	4.3	99	3.3	5.7
				95	3.5	5.5
				90	3.6	5.2
				75	3.8	4.9
12–5	Area 12 Sointula	19	2.4	99	0.7	8.0
				95	1.0	6.8
				90	1.1	5.6
				75	1.3	4.3
12–18	Area 12 Sointula	28	2.5	99	1.2	5.0
				95	1.5	4.4
				90	1.6	4.1
				75	1.8	3.5
12–19	Area 12 Sointula	16	1.9	99	0.7	4.2
				95	0.9	3.4
				90	1.0	3.1
				75	1.2	2.7
12–21*	Area 12 Sointula	51	4.3	99	3.3	5.7
				95	3.5	5.5
				90	3.6	5.2
				75	3.8	4.9
16–5	Jervis Inlet Sechelt	13	4.9	99	1.2	11.8
				95	1.9	9.2
				90	2.3	8.7
				75	3.1	7.6
16–6	Jervis Inlet Sechelt	23	17.9	99	11.1	29.1
				95	12.1	27.3
				90	13.0	25.7
				75	14.4	22.7

Table 2, cont'd.

PFMA Subarea	Survey	No. Transects	Mean	Confidence Level	LCB	UCB
16–7	Jervis Inlet Sechelt	28	4.8	99	3.0	7.5
				95	3.3	6.7
				90	3.5	6.4
				75	4.0	5.9
16–8	Jervis Inlet Sechelt	19	7.8	99	3.7	13.7
				95	4.5	12.1
				90	5.0	11.5
				75	5.8	10.1
16–9	Jervis Inlet Sechelt	10	33.4	99	13.9	62.2
				95	17.6	58.5
				90	19.3	55.2
				75	23.1	49.4
16–10	Jervis Inlet Sechelt	22	9.3	99	5.9	12.8
				95	6.8	12.1
				90	7.2	11.5
				75	7.8	10.9
16–11	Jervis Inlet Sechelt	22	8.2	99	5.8	11.2
				95	6.2	10.4
				90	6.5	10.1
				75	7.0	9.5
16–12	Jervis Inlet Sechelt	29	7.1	99	4.4	11.0
				95	5.0	9.9
				90	5.3	9.6
				75	5.9	8.9
16–13	Jervis Inlet Sechelt	44	7.0	99	4.6	10.1
				95	5.0	9.2
				90	5.4	8.8
				75	5.8	8.2
16–14	Jervis Inlet Sechelt	19	6.4	99	3.7	9.9
				95	4.3	9.0
				90	4.5	8.6
				75	5.1	7.9
16–15	Jervis Inlet Sechelt	32	2.3	99	1.5	3.7
				95	1.7	3.3
				90	1.7	3.1
				75	1.9	2.8
18–1	A18 South Gulf Islands	13	17.8	99	8.1	29.7
				95	10.1	26.9
				90	11.3	25.7
				75	13.4	23.0

Table 2, cont'd.

PFMA Subarea	Survey	No. Transects	Mean	Confidence Level	LCB	UCB
18–2**	A18 South Gulf Islands	16	9.8	99	3.8	20.4
				95	5.0	17.5
				90	5.7	16.3
				75	6.7	14.0
18–3	A18 South Gulf Islands	25	1.2	99	0.2	4.3
				95	0.3	3.3
				90	0.4	2.9
				75	0.6	2.3
18–4	A18 South Gulf Islands	25	6.0	99	2.9	10.2
				95	3.4	9.3
				90	3.7	8.7
				75	4.4	7.8
18–5	A18 South Gulf Islands	42	5.3	99	2.4	9.9
				95	3.0	8.9
				90	3.4	8.3
				75	3.9	7.4
18–6	A18 South Gulf Islands	32	4.9	99	2.1	12.7
				95	2.4	11.6
				90	2.5	10.4
				75	2.9	8.4
18–9**	A18 South Gulf Islands	16	9.8	99	3.8	20.4
				95	5.0	17.5
				90	5.7	16.3
				75	6.7	14.0
18–10	A18 South Gulf Islands	9	0.5	99	0.0	1.3
				95	0.1	1.2
				90	0.1	1.1
				75	0.2	0.9
18–11	A18 South Gulf Islands	13	8.7	99	2.8	15.5
				95	4.3	13.6
				90	4.7	12.8
				75	5.9	11.6

Table 3. Estimated mean weight of *Parastichopus californicus* from samples collected during June 2010 – May 2011. Data for Kildidt Sound were collected from permanent BioTransects. The Subarea mean weight estimate is the mean of the transect averages, and is used for biomass calculations (Duprey et al. 2011).

PFMA Subarea	Survey	Transect no.	Average (g)	SD	Subarea mean (g)
3–11	Area 3 North	10	229.9	43.88	254
3–11	Area 3 North	15	207.4	44.69	
3–11	Area 3 North	35	324.9	51.76	
3–13	Area 3 North	78	225.2	38.35	215
3–13	Area 3 North	92	205.6	41.39	
3–14	Area 3 North	99	222.8	42.03	223
3–15	Area 3 North	257	181.9	31.73	180
3–15	Area 3 North	264	178.4	45.91	
3–17	Area 3 North	287	174.5	60.83	174
6–20	Princess Royal Channel	9	158.2	56.98	166
6–20	Princess Royal Channel	19	171.1	60.09	
6–20	Princess Royal Channel	25	165.8	45.75	
6–20	Princess Royal Channel	34	142.0	43.59	
6–20	Princess Royal Channel	45	164.1	31.93	
6–20	Princess Royal Channel	54	192.9	31.39	
6–21	Princess Royal Channel	66	183.7	89.46	184
6–22	Princess Royal Channel	76	253.6	72.07	254
6–23	Princess Royal Channel	93	208.1	64.75	208
6–24	Princess Royal Channel	102	380.9	89.65	381
7–27	Kildidt Sound	6	243.6	76.05	308
7–27	Kildidt Sound	25	373.8	179.07	
7–27	Kildidt Sound	33	213.3	51.83	
7–27	Kildidt Sound	69	475.5	205.48	
7–27	Kildidt Sound	106	386.4	42.14	
7–27	Kildidt Sound	111	269.6	77.30	
7–27	Kildidt Sound	115	190.4	47.36	
7–28	Kildidt Sound	150	312.6	88.10	309
7–28	Kildidt Sound	167	225.5	92.89	
7–28	Kildidt Sound	170	293.2	64.27	
7–28	Kildidt Sound	181	403.0	106.00	
12–3	Area 12 Sointula	15	324.9	86.46	306
12–3	Area 12 Sointula	25	243.3	68.56	
12–3	Area 12 Sointula	36	262.6	58.35	
12–3	Area 12 Sointula	47	393.8	89.51	

Table 3, cont'd.

PFMA Subarea	Survey	Transect no.	Average (g)	SD	Subarea mean (g)
12–5	Area 12 Sointula	120	323.4	101.24	286
12–5	Area 12 Sointula	128	248.1	62.56	
12–18	Area 12 Sointula	81	511.8	100.81	351
12–18	Area 12 Sointula	101	171.5	56.90	
12–18	Area 12 Sointula	108	369.1	149.12	
12–19	Area 12 Sointula	56	205.0	42.22	205
16–6	Jervis Inlet Sechelt	24	200.1	53.92	176
16–6	Jervis Inlet Sechelt	33	151.8	45.01	
16–7	Jervis Inlet Sechelt	42	149.1	43.33	153
16–7	Jervis Inlet Sechelt	46	171.0	86.14	
16–7	Jervis Inlet Sechelt	60	139.8	41.15	
16–8	Jervis Inlet Sechelt	66	229.6	94.68	212
16–8	Jervis Inlet Sechelt	72	193.7	61.57	
16–9	Jervis Inlet Sechelt	90	137.9	36.90	138
16–10	Jervis Inlet Sechelt	106	164.7	53.13	172
16–10	Jervis Inlet Sechelt	112	179.5	44.27	
16–11	Jervis Inlet Sechelt	118	148.9	49.25	197
16–11	Jervis Inlet Sechelt	130	244.4	62.22	
16–12	Jervis Inlet Sechelt	146	173.0	63.81	200
16–12	Jervis Inlet Sechelt	152	223.6	82.36	
16–12	Jervis Inlet Sechelt	167	203.2	72.70	
16–13	Jervis Inlet Sechelt	171	160.8	63.49	188
16–13	Jervis Inlet Sechelt	181	220.6	88.26	
16–13	Jervis Inlet Sechelt	194	171.4	64.90	
16–13	Jervis Inlet Sechelt	202	199.2	77.90	
16–14	Jervis Inlet Sechelt	218	121.8	34.08	152
16–14	Jervis Inlet Sechelt	225	182.5	65.08	
16–15	Jervis Inlet Sechelt	234	180.8	59.45	181
18–2	A18 South Gulf Islands	21	141.9	31.96	142
18–4	A18 South Gulf Islands	64	209.2	63.93	191
18–4	A18 South Gulf Islands	73	152.1	41.11	
18–4	A18 South Gulf Islands	81	212.1	59.82	
18–5	A18 South Gulf Islands	88	144.4	61.61	240
18–5	A18 South Gulf Islands	102	259.6	90.90	
18–5	A18 South Gulf Islands	111	308.2	111.21	
18–5	A18 South Gulf Islands	113	245.9	64.55	
18–6	A18 South Gulf Islands	125	229.1	98.85	233
18–6	A18 South Gulf Islands	151	225.9	48.59	
18–6	A18 South Gulf Islands	154	242.5	63.60	
18–10	A18 South Gulf Islands	159	297.8	126.32	298

Table 4. Biomass estimates from Open surveys conducted June 2010 – May 2011. Biosamples were not collected from all Subareas; the lowest Wt_{mean} in the same survey was used as Wt_{mean} for Subareas marked with a *(Duprey et al. 2011).

PFMA	Survey	Shoreline Length - exposed	Shoreline Length - protected	Confidence Level	Biomass (kg) LCB	Biomass (kg) UCB
3–11	Area 3 North	0	60,075	99	99,184	236,515
				95	109,865	199,894
				90	114,443	189,212
				75	123,598	177,005
3–12*	Area 3 North	2,739	44,669	99	8,169	39,962
				95	10,212	34,189
				90	11,233	32,264
				75	13,275	28,416
3–13	Area 3 North	0	27,451	99	10,387	27,698
				95	11,376	24,731
				90	11,871	23,247
				75	13,355	21,268
3–14	Area 3 North	113	44,546	99	995	17,913
				95	1,990	13,933
				90	1,990	11,942
				75	2,986	9,952
3–15	Area 3 North	0	65,302	99	5,883	22,356
				95	7,060	18,826
				90	8,236	17,649
				75	9,413	15,296
3–16*	Area 3 North	0	36,490	99	0	0
				95	0	0
				90	0	0
				75	0	0
3–17	Area 3 North	0	22,949	99	1,602	30,832
				95	2,803	26,828
				90	4,004	23,224
				75	5,606	19,220
6–20	Princess Royal Channel	0	119,368	99	212,021	364,598
				95	223,910	334,875
				90	231,837	324,967
				75	241,744	307,134
6–21	Princess Royal Channel	1,338	18,049	99	11,243	72,349
				95	13,235	66,039
				90	14,564	61,722
				75	17,221	49,767
6–22	Princess Royal Channel	0	14,885	99	22,685	89,605
				95	25,709	72,969
				90	27,978	67,298
				75	32,515	58,980
6–23	Princess Royal Channel	908	24,141	99	14,532	63,239
				95	16,540	51,188
				90	17,545	47,171
				75	20,557	41,647

Table 4, cont'd.

PFMA	Survey	Shoreline Length - exposed	Shoreline Length - protected	Confidence Level	Biomass (kg) LCB	Biomass (kg) UCB
6–24	Princess Royal Channel	817	16,807	99	42,401	91,707
				95	46,243	87,225
				90	48,804	83,383
				75	52,646	77,620
12–3	Area 12 Sointula	41	72,670	99	73,414	126,782
				95	77,861	122,335
				90	80,085	115,664
				75	84,532	108,993
12–4*	Area 12 Sointula	0	9,051	99	6,123	10,576
				95	6,494	10,205
				90	6,680	9,648
				75	7,051	9,092
12–5	Area 12 Sointula	0	53,693	99	10,749	122,850
				95	15,356	104,422
				90	16,892	85,995
				75	19,963	66,032
12–18	Area 12 Sointula	0	71,551	99	30,137	125,572
				95	37,672	110,503
				90	40,183	102,969
				75	45,206	87,900
12–19	Area 12 Sointula	5,740	29,053	99	3,907	25,015
				95	5,211	20,250
				90	6,118	18,463
				75	7,248	16,081
12–21*	Area 12 Sointula	0	10,198	99	6,899	11,916
				95	7,317	11,498
				90	7,526	10,871
				75	7,944	10,244
16–5*	Jervis Inlet Sechelt	712	22,875	99	4,034	37,495
				95	6,243	29,288
				90	7,506	27,709
				75	10,032	24,237
16–6	Jervis Inlet Sechelt	426	45,589	99	89,250	233,676
				95	97,274	219,233
				90	104,495	206,396
				75	115,728	182,325
16–7	Jervis Inlet Sechelt	3,235	40,697	99	19,917	47,937
				95	21,785	42,956
				90	23,031	41,088
				75	26,144	37,975
16–8	Jervis Inlet Sechelt	0	32,374	99	25,394	94,027
				95	30,885	83,046
				90	34,316	78,928
				75	39,807	69,319

Table 4, cont'd.

PFMA	Survey	Shoreline Length - exposed	Shoreline Length - protected	Confidence Level	Biomass (kg) LCB	Biomass (kg) UCB
16–9	Jervis Inlet Sechelt	652	14,809	99	28,632	127,339
				95	36,193	119,778
				90	39,667	113,034
				75	47,433	101,181
16–10	Jervis Inlet Sechelt	96	36,108	99	36,642	79,495
				95	42,232	75,148
				90	44,716	71,422
				75	48,442	67,695
16–11	Jervis Inlet Sechelt	1,081	36,630	99	41,853	80,820
				95	44,740	75,048
				90	46,905	72,883
				75	50,513	68,553
16–12	Jervis Inlet Sechelt	0	53,525	99	47,102	117,755
				95	53,525	105,980
				90	56,737	102,768
				75	63,160	95,275
16–13	Jervis Inlet Sechelt	6,180	73,284	99	63,376	139,152
				95	68,887	126,752
				90	74,398	121,241
				75	79,909	112,975
16–14	Jervis Inlet Sechelt	0	27,804	99	15,637	41,839
				95	18,173	38,036
				90	19,018	36,345
				75	21,554	33,387
16–15	Jervis Inlet Sechelt	31	61,843	99	16,790	41,416
				95	19,029	36,939
				90	19,029	34,700
				75	21,268	31,342
18–1*	A18 South Gulf Islands	0	26,712	99	30,724	112,655
				95	38,310	102,034
				90	42,862	97,483
				75	50,828	87,241
18–2	A18 South Gulf Islands	0	29,753	99	16,055	86,188
				95	21,125	73,936
				90	24,082	68,866
				75	28,307	59,149
18–3*	A18 South Gulf Islands	0	63,034	99	1,790	38,489
				95	2,685	29,538
				90	3,580	25,957
				75	5,370	20,587
18–4	A18 South Gulf Islands	0	49,106	99	27,200	95,668
				95	31,889	87,227
				90	34,703	81,599
				75	41,269	73,158

Table 4, cont'd.

PFMA	Survey	Shoreline Length - exposed	Shoreline Length - protected	Confidence Level	Biomass (kg) LCB	Biomass (kg) UCB
18–5	A18 South Gulf Islands	0	82,606	99	47,581	196,272
				95	59,476	176,446
				90	67,406	164,551
				75	77,319	146,708
18–6	A18 South Gulf Islands	0	57,103	99	27,940	168,973
				95	31,932	154,338
				90	33,262	138,372
				75	38,584	111,762
18–9*	A18 South Gulf Islands	0	1,663	99	897	4,817
				95	1,181	4,133
				90	1,346	3,849
				75	1,582	3,306
18–10	A18 South Gulf Islands	0	16,598	99	0	6,430
				95	495	5,935
				90	495	5,441
				75	989	4,452
18–11*	A18 South Gulf Islands	2,866	22,250	99	9,864	49,990
				95	14,603	43,987
				90	15,867	41,459
				75	19,658	37,668

Table 5. Linear density (sea cucumbers per meter shoreline; c/m-sh) for *Parastichopus californicus*, *Cucumaria miniata* and *C. pallida*, by transect, in the Area 3 North survey.

Survey	PFMA	SubArea	Transect No.	Linear Density (c/m-sh)		
				P. californicus	*C. miniata*	*C. pallida*
Area 3 North	3	11	1	28.50	54.0	1.0
Area 3 North	3	11	2	16.75	19.0	0.5
Area 3 North	3	11	3	7.00	0.0	0.0
Area 3 North	3	11	4	3.75	1.5	0.0
Area 3 North	3	11	5	13.50	1.0	0.0
Area 3 North	3	11	6	9.50	5.5	1.5
Area 3 North	3	11	7	7.25	0.0	0.0
Area 3 North	3	11	8	13.75	4.5	0.0
Area 3 North	3	11	9	0.00	0.5	0.0
Area 3 North	3	11	10	18.50	2.0	0.5
Area 3 North	3	11	11	14.50	0.0	0.0
Area 3 North	3	11	12	16.00	19.0	0.0
Area 3 North	3	11	13	12.00	75.0	0.0
Area 3 North	3	11	14	13.25	16.0	0.0
Area 3 North	3	11	15	19.50	3.0	0.0
Area 3 North	3	11	16	8.50	8.5	0.0
Area 3 North	3	11	17	6.75	17.0	0.5
Area 3 North	3	11	18	42.00	0.0	0.0
Area 3 North	3	11	28	15.50	0.5	0.0
Area 3 North	3	11	29	0.75	0.0	1.0
Area 3 North	3	11	30	0.00	0.0	0.0
Area 3 North	3	11	31	6.00	8.0	0.0
Area 3 North	3	11	32	8.75	1.5	0.0
Area 3 North	3	11	33	0.75	11.5	0.0
Area 3 North	3	11	34	2.75	0.0	0.0
Area 3 North	3	11	35	7.50	0.0	0.0
Area 3 North	3	11	36	8.50	0.0	0.0
Area 3 North	3	11	37	1.25	0.0	0.0
Area 3 North	3	11	38	2.50	0.0	0.0
Area 3 North	3	11	39	0.00	0.0	0.0
Area 3 North	3	11	40	0.50	0.5	0.0
Area 3 North	3	11	41	0.00	0.0	0.0
Area 3 North	3	11	42	4.25	1.5	0.0
Area 3 North	3	11	43	13.25	0.5	0.0
Area 3 North	3	12	46	1.75	—	—
Area 3 North	3	12	48	0.75	—	—
Area 3 North	3	12	50	0.00	—	—
Area 3 North	3	12	52	0.25	—	—
Area 3 North	3	12	53	0.00	—	—
Area 3 North	3	12	54	0.00	0.0	0.0
Area 3 North	3	12	55	0.00	0.5	0.0
Area 3 North	3	12	56	0.00	0.0	0.0
Area 3 North	3	12	57	3.25	0.0	0.0
Area 3 North	3	12	58	0.50	18.0	1.0
Area 3 North	3	12	59	0.00	9.5	0.0
Area 3 North	3	12	60	0.00	0.0	0.0
Area 3 North	3	12	61	0.00	0.0	0.0
Area 3 North	3	12	62	0.00	0.5	0.0
Area 3 North	3	12	63	0.00	2.0	1.0
Area 3 North	3	12	64	0.00	0.5	0.0
Area 3 North	3	12	65	1.50	0.5	0.5
Area 3 North	3	12	66	0.00	0.0	0.0
Area 3 North	3	12	67	2.50	—	—
Area 3 North	3	12	68	5.75	—	—
Area 3 North	3	12	70	7.00	—	—
Area 3 North	3	12	72	7.25	—	—
Area 3 North	3	12	75	5.75	—	
Area 3 North	3	12	76	11.75	—	—
Area 3 North	3	13	77	2.25	0.0	0.0
Area 3 North	3	13	78	3.00	0.0	0.5

Table 5, Area 3 North, cont'd.

Survey	PFMA	SubArea	Transect No.	Linear Density (c/m-sh) *P. californicus*	*C. miniata*	*C. pallida*
Area 3 North	3	13	79	2.25	0.0	0.0
Area 3 North	3	13	84	2.75	0.0	0.0
Area 3 North	3	13	85	2.75	0.0	0.0
Area 3 North	3	13	86	3.75	0.0	0.0
Area 3 North	3	13	87	7.75	0.5	0.0
Area 3 North	3	13	88	3.25	35.0	0.0
Area 3 North	3	13	89	8.00	16.0	0.0
Area 3 North	3	13	90	1.50	0.0	0.0
Area 3 North	3	13	91	1.25	0.0	0.0
Area 3 North	3	13	92	1.25	0.0	0.0
Area 3 North	3	14	93	0.00	0.0	0.0
Area 3 North	3	14	94	0.00	0.0	0.0
Area 3 North	3	14	95	0.00	0.0	0.0
Area 3 North	3	14	96	0.00	0.0	0.0
Area 3 North	3	14	97	0.00	0.0	0.0
Area 3 North	3	14	98	2.50	2.0	0.0
Area 3 North	3	14	99	5.50	0.5	0.0
Area 3 North	3	14	100	0.00	0.0	0.0
Area 3 North	3	14	101	0.25	0.0	0.0
Area 3 North	3	14	102	0.00	0.0	0.0
Area 3 North	3	14	103	0.00	0.0	0.0
Area 3 North	3	14	104	2.75	0.0	0.0
Area 3 North	3	14	221	0.00	2.5	0.0
Area 3 North	3	14	222	0.50	0.0	0.0
Area 3 North	3	14	223	0.00	1.0	0.0
Area 3 North	3	14	224	0.25	0.0	0.0
Area 3 North	3	14	225	0.00	0.0	0.0
Area 3 North	3	14	226	0.00	0.0	0.0
Area 3 North	3	14	227	0.00	---	---
Area 3 North	3	14	228	0.00	0.0	0.0
Area 3 North	3	14	229	0.00	0.5	0.0
Area 3 North	3	14	230	0.00	0.5	0.0
Area 3 North	3	14	231	0.00	0.0	0.0
Area 3 North	3	15	232	0.00	0.0	0.0
Area 3 North	3	15	233	0.00	0.0	0.0
Area 3 North	3	15	234	0.00	0.0	0.0
Area 3 North	3	15	235	0.00	0.0	0.0
Area 3 North	3	15	236	0.25	0.0	0.0
Area 3 North	3	15	237	0.25	0.0	0.0
Area 3 North	3	15	238	0.00	0.0	0.0
Area 3 North	3	15	239	0.00	0.0	0.0
Area 3 North	3	15	240	0.00	0.0	0.0
Area 3 North	3	15	241	0.25	0.0	0.0
Area 3 North	3	15	242	0.25	0.0	0.0
Area 3 North	3	15	243	0.00	0.0	0.0
Area 3 North	3	15	244	0.00	0.0	0.0
Area 3 North	3	15	245	0.00	0.0	0.0
Area 3 North	3	15	246	0.00	0.0	0.0
Area 3 North	3	15	247	0.25	0.0	0.0
Area 3 North	3	15	248	0.25	0.0	0.0
Area 3 North	3	15	249	0.00	0.0	0.0
Area 3 North	3	15	250	1.50	0.0	0.0
Area 3 North	3	15	251	2.00	1.0	0.0
Area 3 North	3	15	252	1.50	0.0	2.5
Area 3 North	3	15	253	5.25	1.5	0.5
Area 3 North	3	15	254	0.25	0.0	0.0
Area 3 North	3	15	255	0.00	0.0	0.0
Area 3 North	3	15	256	0.00	0.0	0.0
Area 3 North	3	15	257	0.50	0.0	0.0
Area 3 North	3	15	258	4.25	0.5	0.0

Table 5, Area 3 North, cont'd.

Survey	PFMA	SubArea	Transect No.	Linear Density (c/m-sh)		
				P. californicus	*C. miniata*	*C. pallida*
Area 3 North	3	15	259	1.75	0.0	0.0
Area 3 North	3	15	260	1.50	0.0	0.0
Area 3 North	3	15	261	2.50	0.0	0.0
Area 3 North	3	15	262	4.75	0.0	0.5
Area 3 North	3	15	263	0.25	0.0	0.0
Area 3 North	3	15	264	4.00	0.0	0.0
Area 3 North	3	15	265	1.25	0.0	0.0
Area 3 North	3	15	266	3.00	0.0	0.0
Area 3 North	3	16	267	0.00	0.0	0.0
Area 3 North	3	16	268	0.00	0.0	0.0
Area 3 North	3	16	269	0.00	0.0	0.0
Area 3 North	3	16	270	0.00	0.0	0.0
Area 3 North	3	16	271	0.00	0.0	0.0
Area 3 North	3	16	272	0.00	0.0	0.0
Area 3 North	3	16	273	0.00	0.0	0.0
Area 3 North	3	16	274	0.00	0.0	0.0
Area 3 North	3	16	275	0.00	0.0	0.0
Area 3 North	3	16	276	0.00	0.0	0.0
Area 3 North	3	17	280	13.00	0.0	0.0
Area 3 North	3	17	281	2.00	0.0	0.0
Area 3 North	3	17	282	0.00	0.0	0.0
Area 3 North	3	17	283	1.75	0.0	0.0
Area 3 North	3	17	284	0.25	—	—
Area 3 North	3	17	285	0.00	1.5	0.0
Area 3 North	3	17	286	0.00	0.0	0.0
Area 3 North	3	17	287	2.75	0.0	0.0
Area 3 North	3	17	288	0.00	0.0	0.0
Area 3 North	3	17	289	0.00	0.0	0.0
Area 3 North	3	17	290	0.00	—	—
Area 3 North	3	17	291	12.75	—	—

Table 6. Linear density (sea cucumbers per meter shoreline; c/m-sh) for *Parastichopus californicus*, *Cucumaria miniata* and *C. pallida*, by transect, in the Princess Royal Channel survey.

Survey	PFMA	SubArea	Transect No.	Linear density (c/m-sh)		
				P. Californicus	*C. miniata*	*C. pallida*
Princess Royal Channel	6	20	1	6.75	0.0	0.0
Princess Royal Channel	6	20	2	16.25	1.0	0.0
Princess Royal Channel	6	20	3	11.75	0.5	0.0
Princess Royal Channel	6	20	4	0.75	0.5	1.5
Princess Royal Channel	6	20	5	1.50	0.0	0.0
Princess Royal Channel	6	20	6	11.25	1.0	0.0
Princess Royal Channel	6	20	7	6.75	0.5	0.0
Princess Royal Channel	6	20	8	11.50	1.0	0.0
Princess Royal Channel	6	20	9	7.25	0.0	0.0
Princess Royal Channel	6	20	10	5.75	1.5	1.0
Princess Royal Channel	6	20	11	6.25	0.0	0.0
Princess Royal Channel	6	20	12	18.00	14.0	3.5
Princess Royal Channel	6	20	13	5.25	1.0	0.5
Princess Royal Channel	6	20	14	27.25	9.5	1.0
Princess Royal Channel	6	20	15	26.00	98.5	9.0
Princess Royal Channel	6	20	16	1.25	5.0	2.0
Princess Royal Channel	6	20	17	16.50	14.5	3.0
Princess Royal Channel	6	20	18	2.25	28.0	1.5
Princess Royal Channel	6	20	19	10.00	1.0	1.0
Princess Royal Channel	6	20	20	5.25	0.0	0.0
Princess Royal Channel	6	20	21	3.00	0.0	0.0
Princess Royal Channel	6	20	22	10.50	6.0	4.5
Princess Royal Channel	6	20	23	8.50	45.0	1.5
Princess Royal Channel	6	20	24	8.50	57.0	0.0
Princess Royal Channel	6	20	25	4.50	0.5	0.0
Princess Royal Channel	6	20	26	1.50	0.0	0.0
Princess Royal Channel	6	20	27	10.50	3.5	0.0
Princess Royal Channel	6	20	28	2.75	0.0	0.0
Princess Royal Channel	6	20	29	3.25	2.0	0.0
Princess Royal Channel	6	20	30	19.50	0.0	0.0
Princess Royal Channel	6	20	31	1.50	0.0	0.0
Princess Royal Channel	6	20	32	8.50	21.0	3.5
Princess Royal Channel	6	20	33	8.75	0.0	0.0
Princess Royal Channel	6	20	34	2.75	0.0	0.0
Princess Royal Channel	6	20	35	24.00	133.0	5.5
Princess Royal Channel	6	20	36	13.75	97.5	11.5
Princess Royal Channel	6	20	37	11.75	30.5	3.0
Princess Royal Channel	6	20	38	20.25	19.5	2.0
Princess Royal Channel	6	20	39	2.50	11.0	0.0
Princess Royal Channel	6	20	40	10.50	52.5	3.0
Princess Royal Channel	6	20	41	17.00	26.0	12.5
Princess Royal Channel	6	20	42	18.50	52.0	9.0
Princess Royal Channel	6	20	43	19.25	153.5	8.0
Princess Royal Channel	6	20	44	12.00	37.5	8.0
Princess Royal Channel	6	20	45	40.75	19.5	2.0
Princess Royal Channel	6	20	46	40.75	47.5	10.0
Princess Royal Channel	6	20	47	18.50	0.5	0.0
Princess Royal Channel	6	20	48	58.00	30.0	3.5
Princess Royal Channel	6	20	49	20.50	5.5	0.5
Princess Royal Channel	6	20	50	8.25	0.0	0.0
Princess Royal Channel	6	20	51	26.50	89.5	5.0
Princess Royal Channel	6	20	52	14.25	6.5	2.0
Princess Royal Channel	6	20	53	9.00	24.0	0.5
Princess Royal Channel	6	20	54	9.50	1.0	0.0
Princess Royal Channel	6	20	55	16.50	5.0	0.5
Princess Royal Channel	6	20	56	10.50	0.5	0.0
Princess Royal Channel	6	20	57	3.75	0.0	1.0
Princess Royal Channel	6	20	58	12.50	1.5	0.0
Princess Royal Channel	6	20	59	24.50	0.0	0.0
Princess Royal Channel	6	20	60	12.00	0.5	0.0

Table 6, Princess Royal Channel survey cont'd.

Survey	PFMA	SubArea	Transect No.	Linear density (c/m-sh)		
				P. Californicus	*C. miniata*	*C. pallida*
Princess Royal Channel	6	20	61	33.25	2.5	0.0
Princess Royal Channel	6	20	62	19.75	17.0	5.0
Princess Royal Channel	6	20	63	49.50	5.5	0.0
Princess Royal Channel	6	21	64	8.75	31.5	8.0
Princess Royal Channel	6	21	65	12.75	0.5	0.0
Princess Royal Channel	6	21	66	4.25	3.0	4.0
Princess Royal Channel	6	21	67	0.25	3.0	2.5
Princess Royal Channel	6	21	68	5.75	14.5	8.5
Princess Royal Channel	6	21	69	5.25	0.0	0.0
Princess Royal Channel	6	21	70	3.00	0.0	0.0
Princess Royal Channel	6	21	71	0.25	0.0	0.0
Princess Royal Channel	6	21	72	2.00	0.0	0.0
Princess Royal Channel	6	21	73	41.00	76.5	37.5
Princess Royal Channel	6	22	74	10.25	10.5	3.5
Princess Royal Channel	6	22	75	3.00	22.0	7.5
Princess Royal Channel	6	22	76	10.75	4.0	0.5
Princess Royal Channel	6	22	77	7.25	0.0	0.0
Princess Royal Channel	6	22	78	0.50	0.0	0.0
Princess Royal Channel	6	22	79	7.75	7.0	3.5
Princess Royal Channel	6	22	80	12.50	3.5	1.5
Princess Royal Channel	6	22	81	5.25	0.0	0.0
Princess Royal Channel	6	22	82	24.00	11.0	2.0
Princess Royal Channel	6	22	83	33.25	2.0	0.5
Princess Royal Channel	6	23	84	0.50	28.5	2.0
Princess Royal Channel	6	23	85	22.50	11.5	2.0
Princess Royal Channel	6	23	86	11.00	5.0	3.0
Princess Royal Channel	6	23	87	6.75	0.0	0.0
Princess Royal Channel	6	23	88	3.00	0.5	0.5
Princess Royal Channel	6	23	89	2.25	0.0	0.0
Princess Royal Channel	6	23	90	1.75	0.0	0.0
Princess Royal Channel	6	23	91	0.00	0.0	0.0
Princess Royal Channel	6	23	92	1.75	0.0	0.0
Princess Royal Channel	6	23	93	5.25	0.0	0.0
Princess Royal Channel	6	23	94	5.50	1.5	0.0
Princess Royal Channel	6	23	95	2.00	0.0	0.0
Princess Royal Channel	6	23	96	9.50	60.5	3.5
Princess Royal Channel	6	24	97	20.00	7.0	1.5
Princess Royal Channel	6	24	98	9.75	0.0	0.0
Princess Royal Channel	6	24	99	2.50	0.0	0.0
Princess Royal Channel	6	24	100	8.00	0.0	0.0
Princess Royal Channel	6	24	101	8.75	1.5	0.0
Princess Royal Channel	6	24	102	10.75	3.5	0.0
Princess Royal Channel	6	24	103	5.00	0.0	0.0
Princess Royal Channel	6	24	104	8.50	0.5	0.0
Princess Royal Channel	6	24	105	7.25	5.5	3.5
Princess Royal Channel	6	24	106	17.50	40.5	4.0

Table 7. Linear density (sea cucumbers per meter shoreline; c/m-sh) for *Parastichopus californicus*, *Cucumaria miniata* and *C. pallida*, by transect, in the Area 12 Sointula survey.

Survey	PFMA	SubArea	Transect No.	Linear density (c/m-sh)		
				P. californicus	*C. miniata*	*C. pallida*
Area 12 Sointula	12	4	1	0.00	0.0	0.0
Area 12 Sointula	12	4	2	0.25	0.0	0.0
Area 12 Sointula	12	4	6	11.50	0.0	0.0
Area 12 Sointula	12	4	7	1.75	0.0	0.0
Area 12 Sointula	12	4	8	12.25	0.0	0.0
Area 12 Sointula	12	4	9	2.25	0.0	0.0
Area 12 Sointula	12	3	10	14.75	0.0	0.0
Area 12 Sointula	12	3	11	9.00	0.0	0.0
Area 12 Sointula	12	3	12	3.75	0.0	0.0
Area 12 Sointula	12	3	13	6.00	0.0	0.0
Area 12 Sointula	12	3	14	9.50	0.0	0.0
Area 12 Sointula	12	3	15	10.50	0.0	0.0
Area 12 Sointula	12	3	16	6.25	0.0	0.0
Area 12 Sointula	12	3	17	5.25	0.0	0.0
Area 12 Sointula	12	3	18	2.75	0.0	0.0
Area 12 Sointula	12	3	19	2.00	0.0	0.0
Area 12 Sointula	12	3	20	8.25	0.0	0.0
Area 12 Sointula	12	3	21	0.25	0.0	0.0
Area 12 Sointula	12	3	22	0.00	0.0	0.0
Area 12 Sointula	12	3	23	0.75	0.0	0.0
Area 12 Sointula	12	3	24	4.00	0.0	0.0
Area 12 Sointula	12	3	25	3.50	0.0	0.0
Area 12 Sointula	12	3	26	10.25	0.0	0.0
Area 12 Sointula	12	3	27	5.00	0.0	0.0
Area 12 Sointula	12	3	28	0.00	0.0	0.0
Area 12 Sointula	12	3	29	2.25	0.0	0.0
Area 12 Sointula	12	3	30	2.00	0.0	0.0
Area 12 Sointula	12	3	31	5.25	0.0	0.0
Area 12 Sointula	12	3	32	6.00	0.0	0.0
Area 12 Sointula	12	3	33	7.00	0.0	0.0
Area 12 Sointula	12	3	34	1.25	0.0	0.0
Area 12 Sointula	12	3	35	0.00	0.0	0.0
Area 12 Sointula	12	3	36	4.00	0.0	0.0
Area 12 Sointula	12	3	37	2.50	0.0	0.0
Area 12 Sointula	12	3	38	0.00	0.0	0.0
Area 12 Sointula	12	3	39	6.75	0.0	0.0
Area 12 Sointula	12	3	40	0.50	0.0	0.0
Area 12 Sointula	12	3	41	0.25	0.0	0.0
Area 12 Sointula	12	3	42	6.75	0.0	0.0
Area 12 Sointula	12	3	43	3.50	0.0	0.0
Area 12 Sointula	12	3	44	6.25	0.0	0.0
Area 12 Sointula	12	3	45	4.00	0.0	0.0
Area 12 Sointula	12	3	46	6.75	0.0	0.0
Area 12 Sointula	12	3	47	2.75	0.0	0.0
Area 12 Sointula	12	3	48	2.00	0.0	0.0
Area 12 Sointula	12	3	49	0.25	0.0	0.0
Area 12 Sointula	12	3	50	5.50	0.0	0.0
Area 12 Sointula	12	21	52	2.25	0.0	0.0
Area 12 Sointula	12	21	53	2.00	0.0	0.0
Area 12 Sointula	12	21	54	0.00	0.0	0.0
Area 12 Sointula	12	21	55	10.00	0.0	0.0
Area 12 Sointula	12	19	56	8.75	0.0	0.0
Area 12 Sointula	12	19	57	0.25	0.0	0.0
Area 12 Sointula	12	19	58	0.25	0.0	0.0
Area 12 Sointula	12	19	59	4.00	0.0	0.0
Area 12 Sointula	12	19	61	3.75	0.0	0.0
Area 12 Sointula	12	19	62	0.00	0.0	0.0
Area 12 Sointula	12	19	63	0.00	0.0	0.0
Area 12 Sointula	12	19	64	0.50	0.0	0.0
Area 12 Sointula	12	19	65	0.00	0.0	0.0

Table 7, Area 12 Sointula survey cont'd.

Survey	PFMA	SubArea	Transect No.	Linear density (c/m-sh)		
				P. californicus	*C. miniata*	*C. pallida*
Area 12 Sointula	12	19	66	0.25	0.0	0.0
Area 12 Sointula	12	19	67	1.00	0.0	0.0
Area 12 Sointula	12	19	68	5.50	0.0	0.0
Area 12 Sointula	12	19	69	3.25	0.0	0.0
Area 12 Sointula	12	19	70	0.50	0.0	0.0
Area 12 Sointula	12	19	73	0.00	0.0	0.0
Area 12 Sointula	12	19	74	2.00	0.0	0.0
Area 12 Sointula	12	18	75	1.50	0.0	0.0
Area 12 Sointula	12	18	76	0.25	0.0	0.0
Area 12 Sointula	12	18	77	15.75	0.0	0.0
Area 12 Sointula	12	18	78	10.25	0.0	0.0
Area 12 Sointula	12	18	79	0.50	0.0	0.0
Area 12 Sointula	12	18	80	0.25	0.0	0.0
Area 12 Sointula	12	18	81	2.00	0.0	0.0
Area 12 Sointula	12	18	82	1.00	0.0	0.0
Area 12 Sointula	12	18	83	2.75	0.0	0.0
Area 12 Sointula	12	18	84	0.00	0.0	0.0
Area 12 Sointula	12	18	94	8.50	—	—
Area 12 Sointula	12	18	95	2.75	0.0	0.0
Area 12 Sointula	12	18	96	1.75	0.0	0.0
Area 12 Sointula	12	18	97	5.25	0.0	0.0
Area 12 Sointula	12	18	98	0.00	0.0	0.0
Area 12 Sointula	12	18	99	0.25	0.0	0.0
Area 12 Sointula	12	18	100	2.50	0.0	0.0
Area 12 Sointula	12	18	101	1.50	0.0	0.0
Area 12 Sointula	12	18	102	0.00	0.0	0.0
Area 12 Sointula	12	18	103	1.00	0.0	0.0
Area 12 Sointula	12	18	104	0.75	0.0	0.0
Area 12 Sointula	12	18	105	0.00	0.0	0.0
Area 12 Sointula	12	18	106	0.00	0.0	0.0
Area 12 Sointula	12	18	107	0.00	0.0	0.0
Area 12 Sointula	12	18	108	6.50	0.0	0.0
Area 12 Sointula	12	18	109	2.75	0.0	0.0
Area 12 Sointula	12	18	112	1.00	0.0	0.0
Area 12 Sointula	12	18	113	0.50	0.0	0.0
Area 12 Sointula	12	5	117	0.00	0.0	0.0
Area 12 Sointula	12	5	118	0.75	0.0	0.0
Area 12 Sointula	12	5	119	0.00	0.0	0.0
Area 12 Sointula	12	5	120	6.50	1.0	0.0
Area 12 Sointula	12	5	121	22.25	19.5	0.0
Area 12 Sointula	12	5	122	0.00	0.0	0.0
Area 12 Sointula	12	5	123	0.00	5.0	0.0
Area 12 Sointula	12	5	124	0.00	0.0	0.0
Area 12 Sointula	12	5	125	0.50	0.0	0.0
Area 12 Sointula	12	5	127	5.50	—	—
Area 12 Sointula	12	5	128	0.75	—	—
Area 12 Sointula	12	5	129	0.00	—	—
Area 12 Sointula	12	5	130	2.00	—	—
Area 12 Sointula	12	5	131	4.50	—	—
Area 12 Sointula	12	5	132	0.00	—	—
Area 12 Sointula	12	5	133	0.50	—	—
Area 12 Sointula	12	5	134	1.00	—	—
Area 12 Sointula	12	5	138	0.00	—	—
Area 12 Sointula	12	5	139	0.75	—	—

Table 8. Linear density (sea cucumbers per meter shoreline; c/m-sh) for *Parastichopus californicus*, *Cucumaria miniata* and *C. pallida*, by transect, in the Jervis Inlet – Sechelt survey.

Project	PFMA	SubArea	Transect No.	Linear Density (c/m-sh)		
				P. californicus	*C. miniata*	*C. pallida*
Jervis Inlet Sechelt	16	5	1	14.50	—	—
Jervis Inlet Sechelt	16	5	2	3.25	—	—
Jervis Inlet Sechelt	16	5	3	20.25	—	—
Jervis Inlet Sechelt	16	5	4	0.00	—	—
Jervis Inlet Sechelt	16	5	5	8.00	—	—
Jervis Inlet Sechelt	16	5	6	0.00	—	—
Jervis Inlet Sechelt	16	5	7	0.00	—	—
Jervis Inlet Sechelt	16	5	8	0.00	0.0	0.0
Jervis Inlet Sechelt	16	5	9	3.00	0.0	0.0
Jervis Inlet Sechelt	16	5	10	0.25	0.0	0.0
Jervis Inlet Sechelt	16	5	11	0.00	0.0	0.0
Jervis Inlet Sechelt	16	5	12	0.25	0.0	0.0
Jervis Inlet Sechelt	16	5	13	13.75	0.0	0.0
Jervis Inlet Sechelt	16	6	14	8.00	—	—
Jervis Inlet Sechelt	16	6	15	0.50	—	—
Jervis Inlet Sechelt	16	6	16	18.50	—	—
Jervis Inlet Sechelt	16	6	17	5.25	—	—
Jervis Inlet Sechelt	16	6	18	6.00	—	—
Jervis Inlet Sechelt	16	6	19	0.25	—	—
Jervis Inlet Sechelt	16	6	20	10.75	—	—
Jervis Inlet Sechelt	16	6	21	29.25	0.0	0.0
Jervis Inlet Sechelt	16	6	22	26.50	—	—
Jervis Inlet Sechelt	16	6	23	14.50	—	—
Jervis Inlet Sechelt	16	6	24	19.50	—	—
Jervis Inlet Sechelt	16	6	25	16.75	—	—
Jervis Inlet Sechelt	16	6	26	27.00	—	—
Jervis Inlet Sechelt	16	6	27	68.00	—	—
Jervis Inlet Sechelt	16	6	28	21.75	—	—
Jervis Inlet Sechelt	16	6	29	60.50	5.0	0.5
Jervis Inlet Sechelt	16	6	30	15.75	0.0	0.0
Jervis Inlet Sechelt	16	6	31	12.00	0.5	0.0
Jervis Inlet Sechelt	16	6	32	7.25	0.0	0.0
Jervis Inlet Sechelt	16	6	33	12.00	5.0	0.0
Jervis Inlet Sechelt	16	6	34	7.50	0.0	0.0
Jervis Inlet Sechelt	16	6	35	17.75	0.5	0.0
Jervis Inlet Sechelt	16	6	36	5.50	0.0	0.0
Jervis Inlet Sechelt	16	7	37	15.00	—	—
Jervis Inlet Sechelt	16	7	38	2.00	0.0	0.0
Jervis Inlet Sechelt	16	7	39	12.25	1.0	0.0
Jervis Inlet Sechelt	16	7	40	8.50	0.0	0.0
Jervis Inlet Sechelt	16	7	41	7.00	0.0	0.0
Jervis Inlet Sechelt	16	7	42	4.00	0.0	0.0
Jervis Inlet Sechelt	16	7	43	3.50	0.0	0.0
Jervis Inlet Sechelt	16	7	44	0.00	0.0	0.0
Jervis Inlet Sechelt	16	7	45	1.00	0.5	0.0
Jervis Inlet Sechelt	16	7	46	2.50	0.0	0.0
Jervis Inlet Sechelt	16	7	47	2.75	0.0	0.0
Jervis Inlet Sechelt	16	7	48	0.25	0.5	0.0
Jervis Inlet Sechelt	16	7	49	1.75	0.0	0.0
Jervis Inlet Sechelt	16	7	50	9.25	0.0	0.0
Jervis Inlet Sechelt	16	7	51	0.00	—	—
Jervis Inlet Sechelt	16	7	52	1.25	—	—
Jervis Inlet Sechelt	16	7	53	0.00	—	—
Jervis Inlet Sechelt	16	7	54	0.50	—	—
Jervis Inlet Sechelt	16	7	55	1.25	—	—
Jervis Inlet Sechelt	16	7	56	3.25	—	—
Jervis Inlet Sechelt	16	7	57	1.25	—	—
Jervis Inlet Sechelt	16	7	58	4.50	—	—
Jervis Inlet Sechelt	16	7	59	7.25	—	—
Jervis Inlet Sechelt	16	7	60	9.25	—	—

Table 8, Jervis Inlet – Sechelt survey cont'd.

Project	PFMA	SubArea	Transect No.	Linear Density (c/m-sh)		
				P. californicus	*C. miniata*	*C. pallida*
Jervis Inlet Sechelt	16	7	61	14.50	—	—
Jervis Inlet Sechelt	16	7	62	6.75	—	—
Jervis Inlet Sechelt	16	7	63	3.00	—	—
Jervis Inlet Sechelt	16	7	64	13.25	—	—
Jervis Inlet Sechelt	16	8	65	30.50	—	—
Jervis Inlet Sechelt	16	8	66	10.75	—	—
Jervis Inlet Sechelt	16	8	67	0.00	0.0	0.0
Jervis Inlet Sechelt	16	8	69	0.00	0.0	0.0
Jervis Inlet Sechelt	16	8	70	11.00	0.0	0.0
Jervis Inlet Sechelt	16	8	71	15.00	0.5	0.0
Jervis Inlet Sechelt	16	8	72	5.00	0.0	0.0
Jervis Inlet Sechelt	16	8	73	0.00	0.0	0.0
Jervis Inlet Sechelt	16	8	74	0.00	0.0	0.0
Jervis Inlet Sechelt	16	8	75	14.75	0.0	0.0
Jervis Inlet Sechelt	16	8	76	7.50	0.0	0.0
Jervis Inlet Sechelt	16	8	77	8.75	0.0	0.0
Jervis Inlet Sechelt	16	8	78	1.00	0.0	0.0
Jervis Inlet Sechelt	16	8	79	6.25	0.0	0.0
Jervis Inlet Sechelt	16	8	80	5.25	0.0	0.0
Jervis Inlet Sechelt	16	8	81	2.25	—	—
Jervis Inlet Sechelt	16	8	82	0.25	—	—
Jervis Inlet Sechelt	16	8	83	4.75	—	—
Jervis Inlet Sechelt	16	8	84	24.25	—	—
Jervis Inlet Sechelt	16	9	85	55.50	—	—
Jervis Inlet Sechelt	16	9	86	0.00	—	—
Jervis Inlet Sechelt	16	9	87	14.00	—	—
Jervis Inlet Sechelt	16	9	88	50.00	—	—
Jervis Inlet Sechelt	16	9	89	78.75	—	—
Jervis Inlet Sechelt	16	9	90	13.75	0.5	0.0
Jervis Inlet Sechelt	16	9	91	5.00	0.0	0.0
Jervis Inlet Sechelt	16	9	92	98.50	—	—
Jervis Inlet Sechelt	16	9	93	18.75	—	—
Jervis Inlet Sechelt	16	9	95	0.00	—	—
Jervis Inlet Sechelt	16	10	96	2.75	—	—
Jervis Inlet Sechelt	16	10	97	13.00	—	—
Jervis Inlet Sechelt	16	10	98	6.00	—	—
Jervis Inlet Sechelt	16	10	99	10.25	0.0	0.0
Jervis Inlet Sechelt	16	10	100	9.75	0.0	0.0
Jervis Inlet Sechelt	16	10	101	0.50	0.0	0.0
Jervis Inlet Sechelt	16	10	102	20.75	0.0	0.0
Jervis Inlet Sechelt	16	10	103	1.00	0.0	0.0
Jervis Inlet Sechelt	16	10	104	9.25	—	—
Jervis Inlet Sechelt	16	10	105	4.00	—	—
Jervis Inlet Sechelt	16	10	106	9.00	—	—
Jervis Inlet Sechelt	16	10	107	2.50	—	—
Jervis Inlet Sechelt	16	10	108	3.75	—	—
Jervis Inlet Sechelt	16	10	109	20.00	0.0	0.0
Jervis Inlet Sechelt	16	10	110	18.25	0.0	0.0
Jervis Inlet Sechelt	16	10	111	15.50	0.0	0.0
Jervis Inlet Sechelt	16	10	112	15.50	0.0	0.0
Jervis Inlet Sechelt	16	10	113	11.75	0.0	0.0
Jervis Inlet Sechelt	16	10	114	10.25	0.0	0.0
Jervis Inlet Sechelt	16	10	115	2.00	0.0	0.0
Jervis Inlet Sechelt	16	10	116	14.50	0.0	0.0
Jervis Inlet Sechelt	16	10	117	3.50	0.0	0.0
Jervis Inlet Sechelt	16	11	118	8.50	—	—
Jervis Inlet Sechelt	16	11	119	14.75	—	—
Jervis Inlet Sechelt	16	11	120	12.50	—	—
Jervis Inlet Sechelt	16	11	121	3.75	—	—
Jervis Inlet Sechelt	16	11	122	5.50	—	—

Table 8, Jervis Inlet – Sechelt survey cont'd.

Project	PFMA	SubArea	Transect No.	Linear Density (c/m-sh)		
				P. californicus	*C. miniata*	*C. pallida*
Jervis Inlet Sechelt	16	11	123	13.75	—	—
Jervis Inlet Sechelt	16	11	124	3.25	—	—
Jervis Inlet Sechelt	16	11	125	16.50	1.0	1.0
Jervis Inlet Sechelt	16	11	126	6.50	0.0	0.5
Jervis Inlet Sechelt	16	11	127	4.25	0.5	0.0
Jervis Inlet Sechelt	16	11	128	4.75	0.0	0.0
Jervis Inlet Sechelt	16	11	129	5.50	0.0	0.0
Jervis Inlet Sechelt	16	11	130	15.50	0.0	1.0
Jervis Inlet Sechelt	16	11	131	0.00	1.5	0.0
Jervis Inlet Sechelt	16	11	132	0.00	0.0	0.0
Jervis Inlet Sechelt	16	11	133	9.50	—	—
Jervis Inlet Sechelt	16	11	134	9.50	—	—
Jervis Inlet Sechelt	16	11	135	19.00	—	—
Jervis Inlet Sechelt	16	11	136	8.00	—	—
Jervis Inlet Sechelt	16	11	137	10.50	—	—
Jervis Inlet Sechelt	16	11	138	7.25	0.0	0.0
Jervis Inlet Sechelt	16	11	139	2.00	0.0	0.0
Jervis Inlet Sechelt	16	12	140	24.00	1.0	2.0
Jervis Inlet Sechelt	16	12	141	20.25	1.5	10.5
Jervis Inlet Sechelt	16	12	142	0.25	0.0	0.0
Jervis Inlet Sechelt	16	12	143	9.00	0.0	0.0
Jervis Inlet Sechelt	16	12	144	11.50	0.5	1.0
Jervis Inlet Sechelt	16	12	145	23.25	0.0	0.0
Jervis Inlet Sechelt	16	12	146	9.00	0.0	0.0
Jervis Inlet Sechelt	16	12	147	5.75	1.0	2.0
Jervis Inlet Sechelt	16	12	148	10.00	0.0	0.0
Jervis Inlet Sechelt	16	12	149	4.75	0.0	0.0
Jervis Inlet Sechelt	16	12	150	2.25	0.0	0.5
Jervis Inlet Sechelt	16	12	151	6.50	0.0	0.5
Jervis Inlet Sechelt	16	12	152	3.75	0.0	1.5
Jervis Inlet Sechelt	16	12	153	0.00	—	—
Jervis Inlet Sechelt	16	12	154	2.75	—	—
Jervis Inlet Sechelt	16	12	155	0.00	—	—
Jervis Inlet Sechelt	16	12	156	5.75	—	—
Jervis Inlet Sechelt	16	12	157	1.00	—	—
Jervis Inlet Sechelt	16	12	158	8.25	—	—
Jervis Inlet Sechelt	16	12	159	16.75	—	—
Jervis Inlet Sechelt	16	12	160	4.75	—	—
Jervis Inlet Sechelt	16	12	161	6.50	—	—
Jervis Inlet Sechelt	16	12	162	1.75	—	—
Jervis Inlet Sechelt	16	12	163	7.00	—	—
Jervis Inlet Sechelt	16	12	164	10.25	—	—
Jervis Inlet Sechelt	16	12	165	0.25	—	—
Jervis Inlet Sechelt	16	12	166	0.00	—	—
Jervis Inlet Sechelt	16	12	167	9.50	—	—
Jervis Inlet Sechelt	16	12	168	0.50	—	—
Jervis Inlet Sechelt	16	13	169	16.50	0.0	0.0
Jervis Inlet Sechelt	16	13	170	14.00	0.0	0.0
Jervis Inlet Sechelt	16	13	171	2.50	0.0	0.0
Jervis Inlet Sechelt	16	13	172	1.50	0.0	0.0
Jervis Inlet Sechelt	16	13	173	1.25	0.0	0.0
Jervis Inlet Sechelt	16	13	174	7.00	0.0	0.0
Jervis Inlet Sechelt	16	13	175	4.00	0.0	0.0
Jervis Inlet Sechelt	16	13	176	26.50	0.0	0.0
Jervis Inlet Sechelt	16	13	177	7.25	0.0	0.0
Jervis Inlet Sechelt	16	13	178	1.00	0.0	0.0
Jervis Inlet Sechelt	16	13	179	1.50	0.0	0.0
Jervis Inlet Sechelt	16	13	180	0.00	0.0	0.0
Jervis Inlet Sechelt	16	13	181	3.25	0.0	0.0
Jervis Inlet Sechelt	16	13	182	3.25	0.0	0.0

Table 8, Jervis Inlet – Sechelt survey cont'd.

Project	PFMA	SubArea	Transect No.	Linear Density (c/m-sh)		
				P. californicus	*C. miniata*	*C. pallida*
Jervis Inlet Sechelt	16	13	183	3.25	0.0	0.0
Jervis Inlet Sechelt	16	13	184	8.00	0.0	1.0
Jervis Inlet Sechelt	16	13	185	2.75	0.0	2.0
Jervis Inlet Sechelt	16	13	186	9.75	0.0	1.0
Jervis Inlet Sechelt	16	13	187	0.00	0.0	0.0
Jervis Inlet Sechelt	16	13	188	1.50	0.0	1.0
Jervis Inlet Sechelt	16	13	189	7.25	0.0	0.0
Jervis Inlet Sechelt	16	13	190	2.25	0.0	0.0
Jervis Inlet Sechelt	16	13	191	0.25	0.5	0.5
Jervis Inlet Sechelt	16	13	192	2.25	—	—
Jervis Inlet Sechelt	16	13	193	6.00	—	—
Jervis Inlet Sechelt	16	13	194	2.25	—	—
Jervis Inlet Sechelt	16	13	195	8.50	—	—
Jervis Inlet Sechelt	16	13	196	9.00	—	—
Jervis Inlet Sechelt	16	13	197	4.50	—	—
Jervis Inlet Sechelt	16	13	198	22.25	0.5	0.0
Jervis Inlet Sechelt	16	13	199	20.00	3.0	3.5
Jervis Inlet Sechelt	16	13	200	6.00	0.0	0.0
Jervis Inlet Sechelt	16	13	201	4.25	0.0	0.0
Jervis Inlet Sechelt	16	13	202	6.75	0.0	0.0
Jervis Inlet Sechelt	16	13	203	8.00	—	—
Jervis Inlet Sechelt	16	13	204	0.00	—	—
Jervis Inlet Sechelt	16	13	205	6.50	—	—
Jervis Inlet Sechelt	16	13	206	7.50	—	—
Jervis Inlet Sechelt	16	13	207	21.50	—	—
Jervis Inlet Sechelt	16	13	208	2.00	—	—
Jervis Inlet Sechelt	16	13	209	0.00	—	—
Jervis Inlet Sechelt	16	13	210	4.25	—	—
Jervis Inlet Sechelt	16	13	211	20.00	—	—
Jervis Inlet Sechelt	16	13	212	21.25	—	—
Jervis Inlet Sechelt	16	14	213	11.75	—	—
Jervis Inlet Sechelt	16	14	214	11.75	—	—
Jervis Inlet Sechelt	16	14	215	11.50	—	—
Jervis Inlet Sechelt	16	14	216	6.25	—	—
Jervis Inlet Sechelt	16	14	217	0.25	—	—
Jervis Inlet Sechelt	16	14	218	17.50	—	—
Jervis Inlet Sechelt	16	14	219	7.00	—	—
Jervis Inlet Sechelt	16	14	220	1.75	—	—
Jervis Inlet Sechelt	16	14	221	0.25	—	—
Jervis Inlet Sechelt	16	14	222	0.00	—	—
Jervis Inlet Sechelt	16	14	223	7.75	—	—
Jervis Inlet Sechelt	16	14	224	0.25	—	—
Jervis Inlet Sechelt	16	14	225	5.25	0.0	1.0
Jervis Inlet Sechelt	16	14	226	7.00	1.0	0.0
Jervis Inlet Sechelt	16	14	227	17.25	0.0	1.5
Jervis Inlet Sechelt	16	14	228	0.50	0.0	0.0
Jervis Inlet Sechelt	16	14	229	0.00	0.0	0.0
Jervis Inlet Sechelt	16	14	230	11.50	0.0	0.5
Jervis Inlet Sechelt	16	14	231	4.25	0.0	1.0
Jervis Inlet Sechelt	16	15	232	1.50	0.0	0.0
Jervis Inlet Sechelt	16	15	233	2.00	0.0	0.0
Jervis Inlet Sechelt	16	15	234	4.00	0.0	0.0
Jervis Inlet Sechelt	16	15	235	5.25	0.0	0.0
Jervis Inlet Sechelt	16	15	236	7.00	0.0	0.5
Jervis Inlet Sechelt	16	15	237	0.50	0.0	0.0
Jervis Inlet Sechelt	16	15	238	0.00	0.0	0.0
Jervis Inlet Sechelt	16	15	239	3.25	0.0	0.0
Jervis Inlet Sechelt	16	15	240	0.75	0.0	0.0
Jervis Inlet Sechelt	16	15	241	0.00	0.0	0.0
Jervis Inlet Sechelt	16	15	242	2.75	0.0	0.0

Table 8, Jervis Inlet – Sechelt survey cont'd.

Project	PFMA	SubArea	Transect No.	Linear Density (c/m-sh)		
				P. californicus	*C. miniata*	*C. pallida*
Jervis Inlet Sechelt	16	15	243	0.00	0.0	0.0
Jervis Inlet Sechelt	16	15	244	1.50	—	—
Jervis Inlet Sechelt	16	15	245	1.25	—	—
Jervis Inlet Sechelt	16	15	246	1.75	—	—
Jervis Inlet Sechelt	16	15	247	3.25	—	—
Jervis Inlet Sechelt	16	15	248	10.50	—	—
Jervis Inlet Sechelt	16	15	249	0.25	—	—
Jervis Inlet Sechelt	16	15	250	2.75	—	—
Jervis Inlet Sechelt	16	15	251	0.00	—	—
Jervis Inlet Sechelt	16	15	252	0.25	—	—
Jervis Inlet Sechelt	16	15	253	0.75	—	—
Jervis Inlet Sechelt	16	15	254	0.00	0.0	0.0
Jervis Inlet Sechelt	16	15	255	2.50	0.0	0.0
Jervis Inlet Sechelt	16	15	256	0.25	0.0	0.0
Jervis Inlet Sechelt	16	15	257	3.50	0.0	0.0
Jervis Inlet Sechelt	16	15	258	1.25	0.0	0.0
Jervis Inlet Sechelt	16	15	259	4.25	—	—
Jervis Inlet Sechelt	16	15	260	4.25	—	—
Jervis Inlet Sechelt	16	15	261	5.50	—	—
Jervis Inlet Sechelt	16	15	262	0.00	—	—
Jervis Inlet Sechelt	16	15	263	3.75	—	—

Table 9. Linear density (sea cucumbers per meter shoreline; c/m-sh) for *Parastichopus californicus*, *Cucumaria miniata* and *C. pallida*, by transect, in the A18 South Gulf Islands survey.

Survey	PFMA	SubArea	Transect No.	Linear Density (c/m-sh)		
				P. californicus	*C. miniata*	*C. pallida*
A18 South Gulf Islands	18	1	1	20.50	0.0	0.0
A18 South Gulf Islands	18	1	2	1.50	0.0	0.0
A18 South Gulf Islands	18	1	3	8.50	0.0	0.0
A18 South Gulf Islands	18	1	4	0.75	0.0	0.0
A18 South Gulf Islands	18	1	5	0.00	0.0	0.0
A18 South Gulf Islands	18	1	6	25.75	3.0	0.0
A18 South Gulf Islands	18	1	7	32.50	0.0	0.0
A18 South Gulf Islands	18	1	8	28.00	—	—
A18 South Gulf Islands	18	1	9	32.50	7.0	0.0
A18 South Gulf Islands	18	1	10	6.50	—	—
A18 South Gulf Islands	18	1	11	1.50	—	—
A18 South Gulf Islands	18	1	12	21.50	0.0	0.0
A18 South Gulf Islands	18	1	13	51.50	—	—
A18 South Gulf Islands	18	2	14	15.00	0.0	0.0
A18 South Gulf Islands	18	2	15	0.75	0.0	0.0
A18 South Gulf Islands	18	2	16	22.25	19.5	0.0
A18 South Gulf Islands	18	2	17	2.50	1.0	0.0
A18 South Gulf Islands	18	2	18	5.75	—	—
A18 South Gulf Islands	18	2	19	2.00	—	—
A18 South Gulf Islands	18	2	20	0.00	—	—
A18 South Gulf Islands	18	2	21	0.25	2.5	0.0
A18 South Gulf Islands	18	2	22	16.25	0.5	0.0
A18 South Gulf Islands	18	2	23	0.25	0.0	0.0
A18 South Gulf Islands	18	2	24	0.00	0.0	0.0
A18 South Gulf Islands	18	2	25	18.50	1.5	0.5
A18 South Gulf Islands	18	2	26	0.25	—	—
A18 South Gulf Islands	18	2	27	46.00	0.0	0.0
A18 South Gulf Islands	18	2	28	17.25	2.0	0.0
A18 South Gulf Islands	18	3	29	3.50	—	—
A18 South Gulf Islands	18	3	30	8.50	—	—
A18 South Gulf Islands	18	3	31	1.25	—	—
A18 South Gulf Islands	18	3	32	0.00	3.5	0.0
A18 South Gulf Islands	18	3	33	0.00	0.0	0.0
A18 South Gulf Islands	18	3	34	0.00	0.0	0.0
A18 South Gulf Islands	18	3	38	0.00	0.0	0.0
A18 South Gulf Islands	18	3	39	0.00	0.0	0.0
A18 South Gulf Islands	18	3	40	0.00	0.0	0.0
A18 South Gulf Islands	18	3	41	0.00	0.0	0.0
A18 South Gulf Islands	18	3	42	0.25	0.0	0.0
A18 South Gulf Islands	18	3	43	0.00	0.0	0.0
A18 South Gulf Islands	18	3	44	0.00	0.0	0.0
A18 South Gulf Islands	18	3	45	0.00	0.0	0.0
A18 South Gulf Islands	18	3	46	0.00	0.0	0.0
A18 South Gulf Islands	18	3	47	0.00	0.0	0.0
A18 South Gulf Islands	18	3	48	14.25	0.0	0.0
A18 South Gulf Islands	18	3	49	1.50	—	—
A18 South Gulf Islands	18	3	50	0.00	—	—
A18 South Gulf Islands	18	3	51	0.00	—	—
A18 South Gulf Islands	18	3	52	0.00	0.0	0.0
A18 South Gulf Islands	18	3	53	0.00	0.0	0.0
A18 South Gulf Islands	18	3	54	0.00	0.0	0.0
A18 South Gulf Islands	18	3	55	0.75	0.0	0.0
A18 South Gulf Islands	18	3	56	0.00	0.0	0.0
A18 South Gulf Islands	18	4	57	4.25	—	—
A18 South Gulf Islands	18	4	58	13.25	—	—
A18 South Gulf Islands	18	4	59	16.00	—	—
A18 South Gulf Islands	18	4	60	0.25	—	—
A18 South Gulf Islands	18	4	61	0.00	—	—
A18 South Gulf Islands	18	4	62	0.25	—	—
A18 South Gulf Islands	18	4	63	4.25	—	—

Table 9, A18 South Gulf Islands survey cont'd.

Survey	PFMA	SubArea	Transect No.	Linear Density (c/m-sh) *P. californicus*	*C. miniata*	*C. pallida*
A18 South Gulf Islands	18	4	64	14.00	1.0	0.0
A18 South Gulf Islands	18	4	65	0.00	0.0	0.0
A18 South Gulf Islands	18	4	66	21.00	3.5	0.0
A18 South Gulf Islands	18	4	67	0.00	0.0	0.0
A18 South Gulf Islands	18	4	68	0.00	3.0	0.0
A18 South Gulf Islands	18	4	69	4.75	0.5	0.0
A18 South Gulf Islands	18	4	70	12.50	0.0	0.0
A18 South Gulf Islands	18	4	71	12.50	0.0	0.0
A18 South Gulf Islands	18	4	72	10.00	0.0	0.0
A18 South Gulf Islands	18	4	73	9.75	0.0	0.0
A18 South Gulf Islands	18	4	74	0.00	0.0	0.0
A18 South Gulf Islands	18	4	75	0.00	0.0	0.0
A18 South Gulf Islands	18	4	76	0.00	0.0	0.0
A18 South Gulf Islands	18	4	77	0.00	0.0	0.0
A18 South Gulf Islands	18	4	78	0.00	0.0	0.0
A18 South Gulf Islands	18	4	79	0.25	0.0	0.0
A18 South Gulf Islands	18	4	80	2.75	0.0	0.0
A18 South Gulf Islands	18	4	81	23.75	0.5	0.0
A18 South Gulf Islands	18	5	82	0.00	1.0	0.0
A18 South Gulf Islands	18	5	83	18.75	0.0	0.0
A18 South Gulf Islands	18	5	84	0.00	0.5	0.5
A18 South Gulf Islands	18	5	85	8.00	0.0	0.0
A18 South Gulf Islands	18	5	86	0.00	0.5	0.0
A18 South Gulf Islands	18	5	87	14.25	1.0	0.0
A18 South Gulf Islands	18	5	88	1.75	0.0	0.0
A18 South Gulf Islands	18	5	89	4.50	0.5	0.0
A18 South Gulf Islands	18	5	90	12.25	0.0	0.0
A18 South Gulf Islands	18	5	91	0.00	0.0	0.0
A18 South Gulf Islands	18	5	92	0.00	---	---
A18 South Gulf Islands	18	5	93	5.25	---	---
A18 South Gulf Islands	18	5	94	0.00	---	---
A18 South Gulf Islands	18	5	95	0.00	---	---
A18 South Gulf Islands	18	5	96	0.00	---	---
A18 South Gulf Islands	18	5	97	0.00	---	---
A18 South Gulf Islands	18	5	98	0.25	---	---
A18 South Gulf Islands	18	5	100	0.00	0.0	0.0
A18 South Gulf Islands	18	5	101	9.00	0.0	0.0
A18 South Gulf Islands	18	5	102	1.50	0.0	0.0
A18 South Gulf Islands	18	5	103	6.50	---	---
A18 South Gulf Islands	18	5	104	1.75	---	---
A18 South Gulf Islands	18	5	105	0.75	---	---
A18 South Gulf Islands	18	5	106	9.50	0.0	0.0
A18 South Gulf Islands	18	5	107	0.25	4.0	0.0
A18 South Gulf Islands	18	5	108	0.00	0.5	0.0
A18 South Gulf Islands	18	5	109	24.00	0.0	0.0
A18 South Gulf Islands	18	5	110	17.25	0.0	0.0
A18 South Gulf Islands	18	5	111	1.75	0.0	0.0
A18 South Gulf Islands	18	5	112	40.75	---	---
A18 South Gulf Islands	18	5	113	31.00	---	---
A18 South Gulf Islands	18	5	114	0.00	---	---
A18 South Gulf Islands	18	5	115	0.00	---	---
A18 South Gulf Islands	18	5	116	0.00	---	---
A18 South Gulf Islands	18	5	117	0.00	---	---
A18 South Gulf Islands	18	5	118	0.00	---	---
A18 South Gulf Islands	18	5	119	0.00	---	---
A18 South Gulf Islands	18	5	120	0.00	---	---
A18 South Gulf Islands	18	5	121	0.00	---	---
A18 South Gulf Islands	18	5	122	0.00	---	---
A18 South Gulf Islands	18	5	123	13.50	---	---
A18 South Gulf Islands	18	5	124	0.00	---	---

Table 9, A18 South Gulf Islands survey cont'd.

Survey	PFMA	SubArea	Transect No.	Linear Density (c/m-sh) *P. californicus*	*C. miniata*	*C. pallida*
A18 South Gulf Islands	18	6	125	2.00	—	—
A18 South Gulf Islands	18	6	126	0.00	—	—
A18 South Gulf Islands	18	6	127	1.75	—	—
A18 South Gulf Islands	18	6	128	9.00	0.0	0.0
A18 South Gulf Islands	18	6	129	0.50	0.0	0.0
A18 South Gulf Islands	18	6	130	4.50	0.0	0.0
A18 South Gulf Islands	18	6	131	0.25	0.0	0.0
A18 South Gulf Islands	18	6	132	0.50	0.0	0.0
A18 South Gulf Islands	18	6	133	0.00	—	—
A18 South Gulf Islands	18	6	134	9.50	—	—
A18 South Gulf Islands	18	6	135	0.00	—	—
A18 South Gulf Islands	18	6	136	0.00	—	—
A18 South Gulf Islands	18	6	137	0.00	—	—
A18 South Gulf Islands	18	6	138	0.75	—	—
A18 South Gulf Islands	18	6	139	0.25	—	—
A18 South Gulf Islands	18	6	140	10.50	—	—
A18 South Gulf Islands	18	6	141	0.75	—	—
A18 South Gulf Islands	18	6	142	0.00	—	—
A18 South Gulf Islands	18	6	143	0.00	—	—
A18 South Gulf Islands	18	6	144	3.00	—	—
A18 South Gulf Islands	18	6	145	0.00	—	—
A18 South Gulf Islands	18	6	146	3.25	—	—
A18 South Gulf Islands	18	6	147	64.25	—	—
A18 South Gulf Islands	18	6	148	0.00	—	—
A18 South Gulf Islands	18	6	149	0.25	—	—
A18 South Gulf Islands	18	6	150	2.25	—	—
A18 South Gulf Islands	18	6	151	8.25	—	—
A18 South Gulf Islands	18	6	152	0.00	—	—
A18 South Gulf Islands	18	6	153	4.50	—	—
A18 South Gulf Islands	18	6	154	10.75	—	—
A18 South Gulf Islands	18	6	155	5.75	—	—
A18 South Gulf Islands	18	6	156	13.00	—	—
A18 South Gulf Islands	18	9	157	10.00	0.0	0.0
A18 South Gulf Islands	18	10	158	2.00	0.0	0.0
A18 South Gulf Islands	18	10	159	1.75	1.0	0.0
A18 South Gulf Islands	18	10	160	1.00	0.0	0.0
A18 South Gulf Islands	18	10	161	0.00	0.0	0.0
A18 South Gulf Islands	18	10	162	0.00	0.0	0.0
A18 South Gulf Islands	18	10	163	0.00	0.0	0.0
A18 South Gulf Islands	18	10	164	0.00	1.5	0.0
A18 South Gulf Islands	18	10	165	0.00	0.0	0.0
A18 South Gulf Islands	18	10	166	0.00	0.0	0.0
A18 South Gulf Islands	18	11	167	1.00	—	—
A18 South Gulf Islands	18	11	168	22.75	—	—
A18 South Gulf Islands	18	11	169	11.75	—	—
A18 South Gulf Islands	18	11	170	0.00	—	—
A18 South Gulf Islands	18	11	171	22.25	—	—
A18 South Gulf Islands	18	11	172	0.00	—	—
A18 South Gulf Islands	18	11	173	0.00	—	—
A18 South Gulf Islands	18	11	174	0.00	—	—
A18 South Gulf Islands	18	11	175	0.00	—	—
A18 South Gulf Islands	18	11	176	19.25	—	—
A18 South Gulf Islands	18	11	177	8.00	—	—
A18 South Gulf Islands	18	11	178	10.00	—	—
A18 South Gulf Islands	18	11	179	17.75	—	—

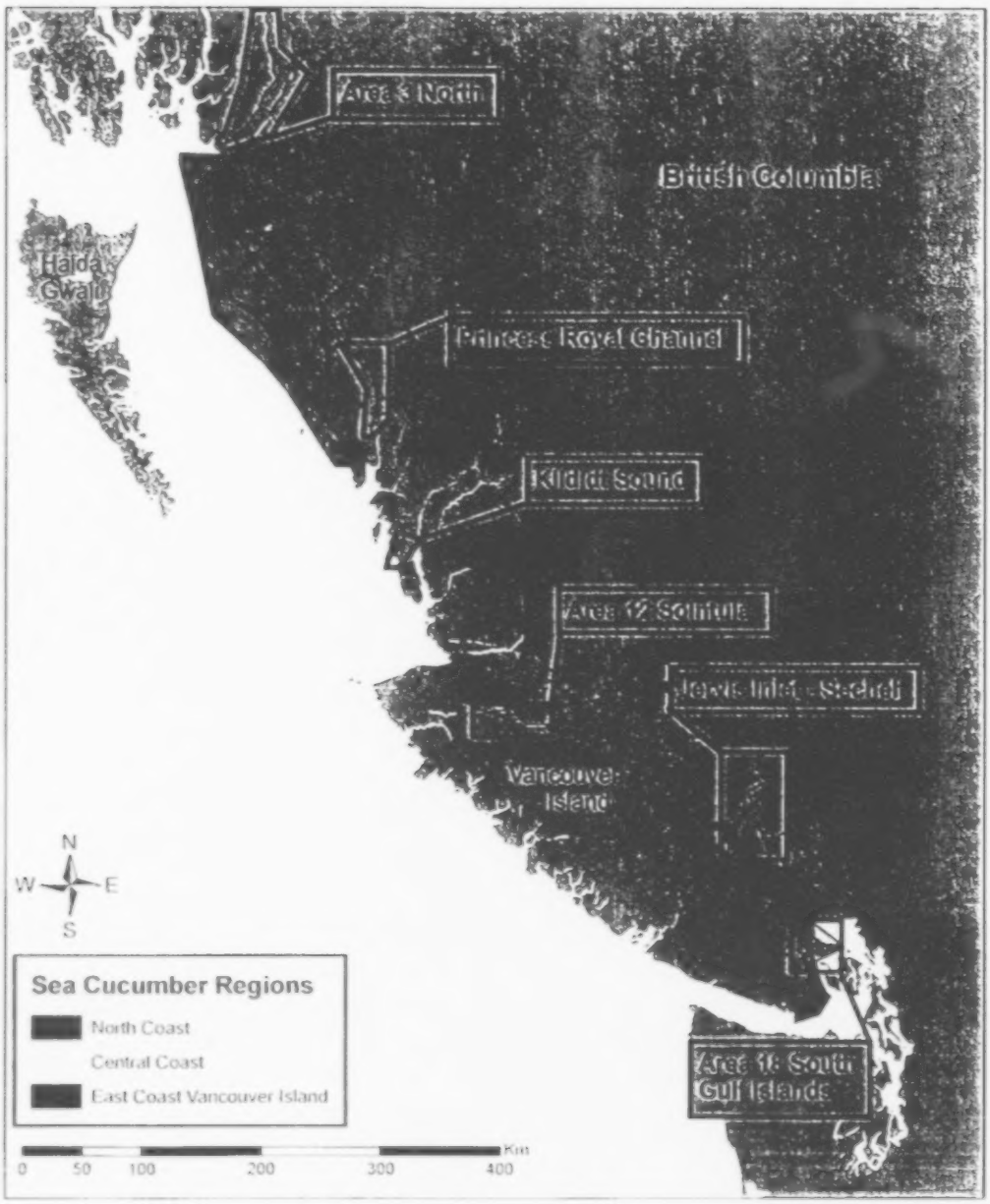

Figure 1. Sea cucumber surveys conducted June 2010 to May 2011. Open surveys were conducted in Area 3 North, Princess Royal Channel, Area 12 Sointula, Jervis Inlet – Sechelt and Area 18 South Gulf Islands. A permanent Bio Transect survey was conducted in Kildidt Sound.

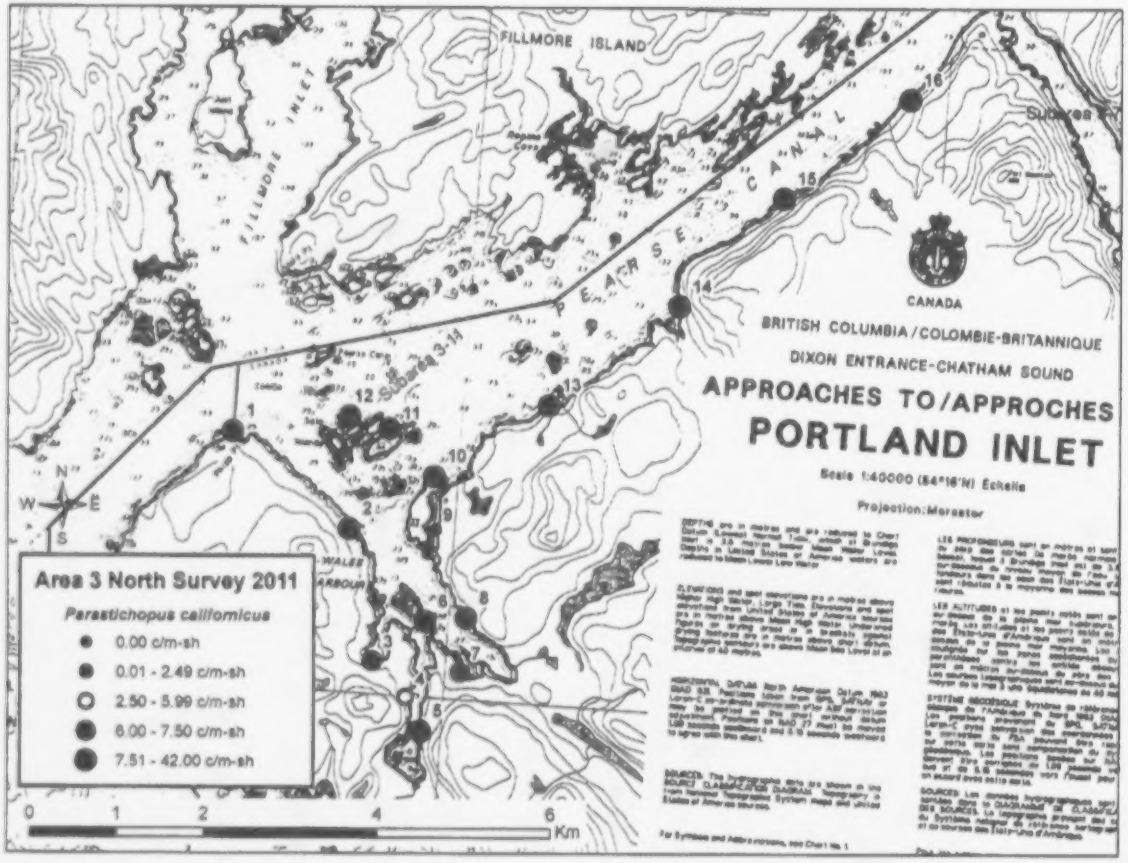

Figure 2a. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in a portion of PFMA 3–11, surveyed as part of the Area 3 North survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 5.99 c/m-sh); green = productive locations (between 6.00 c/m-sh and the bootstrapped lower 90% confidence bound calculated for the Subarea); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

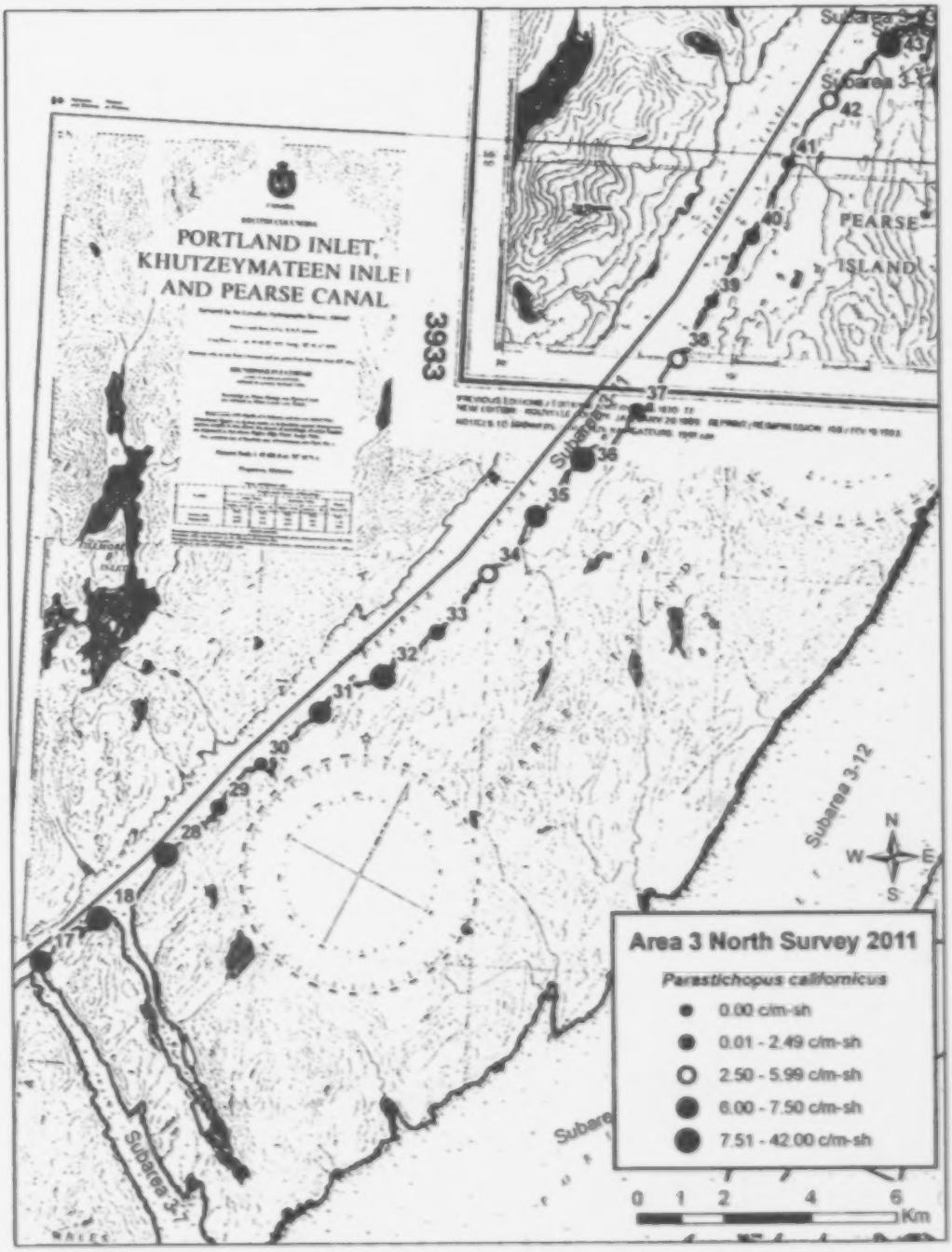

Figure 2b. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in a portion of PFMA 3–11, surveyed as part of the Area 3 North survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 5.99 c/m-sh); green = productive locations (between 6.00 c/m-sh and the bootstrapped lower 90% confidence bound calculated for the Subarea); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

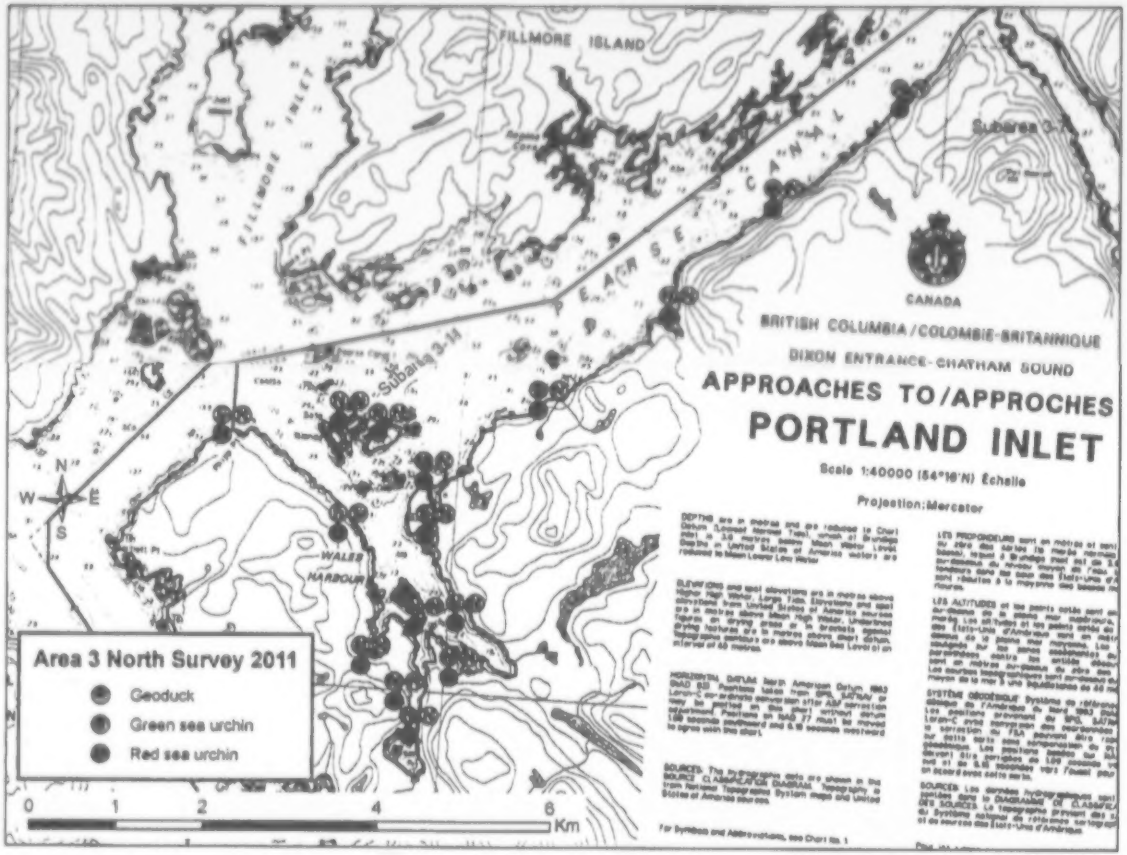

Figure 3a. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 3–11. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

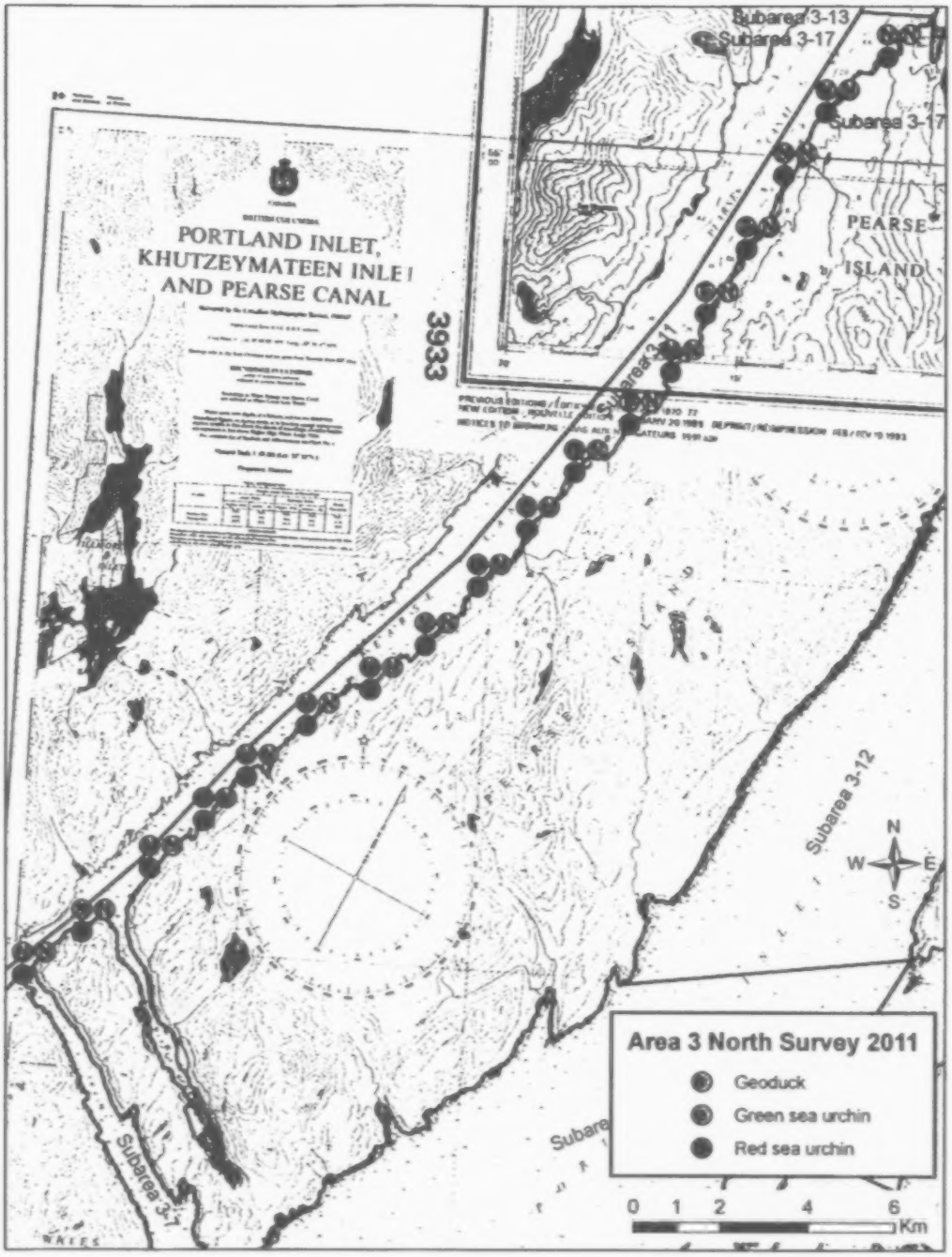

Figure 3b. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 3–11. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

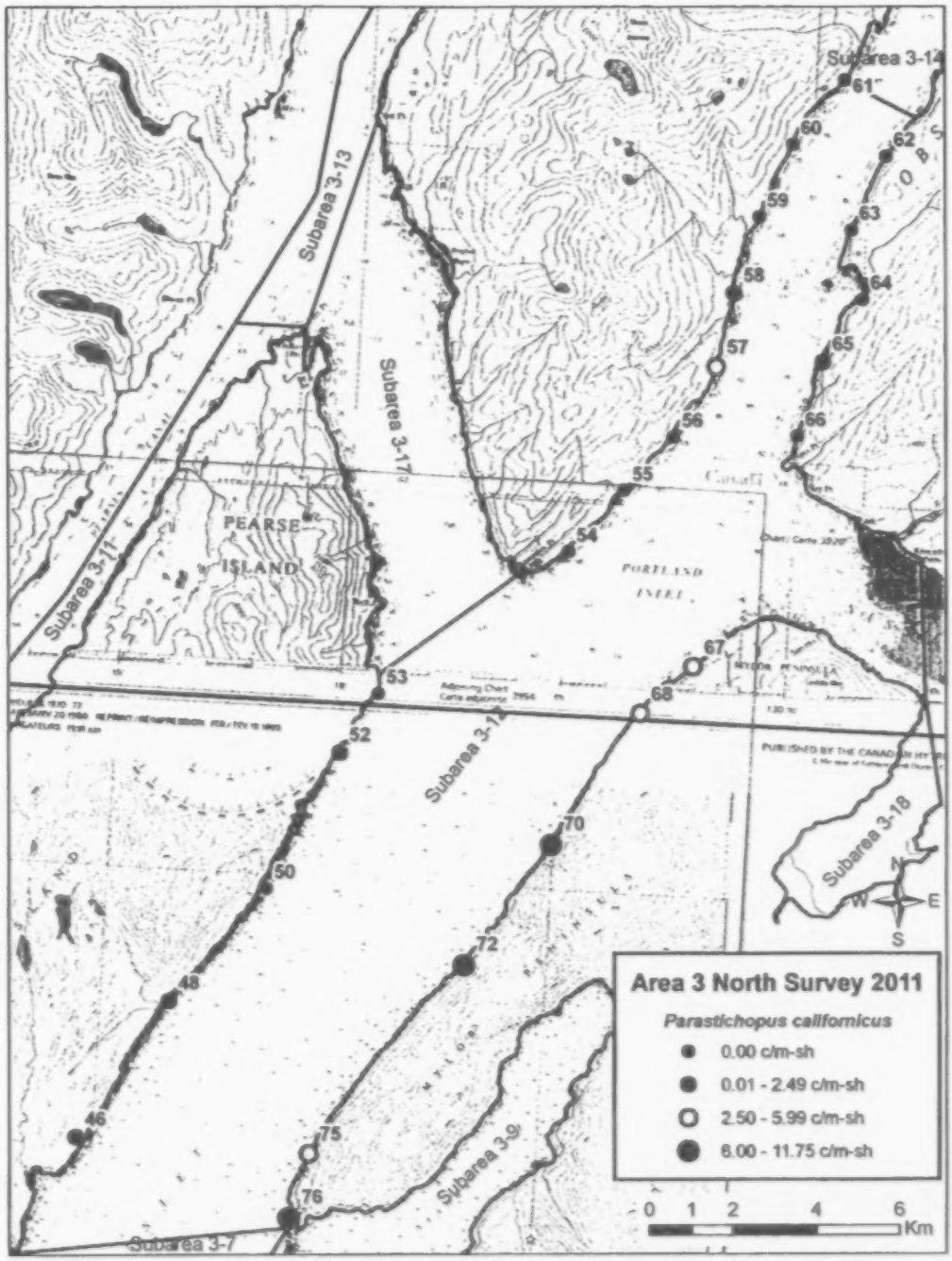

Figure 4. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 3–12, surveyed as part of the Area 3 North survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 5.99 c/m-sh); green = productive locations (between 6.00 c/m-sh and the maximum observed density in the Subarea).

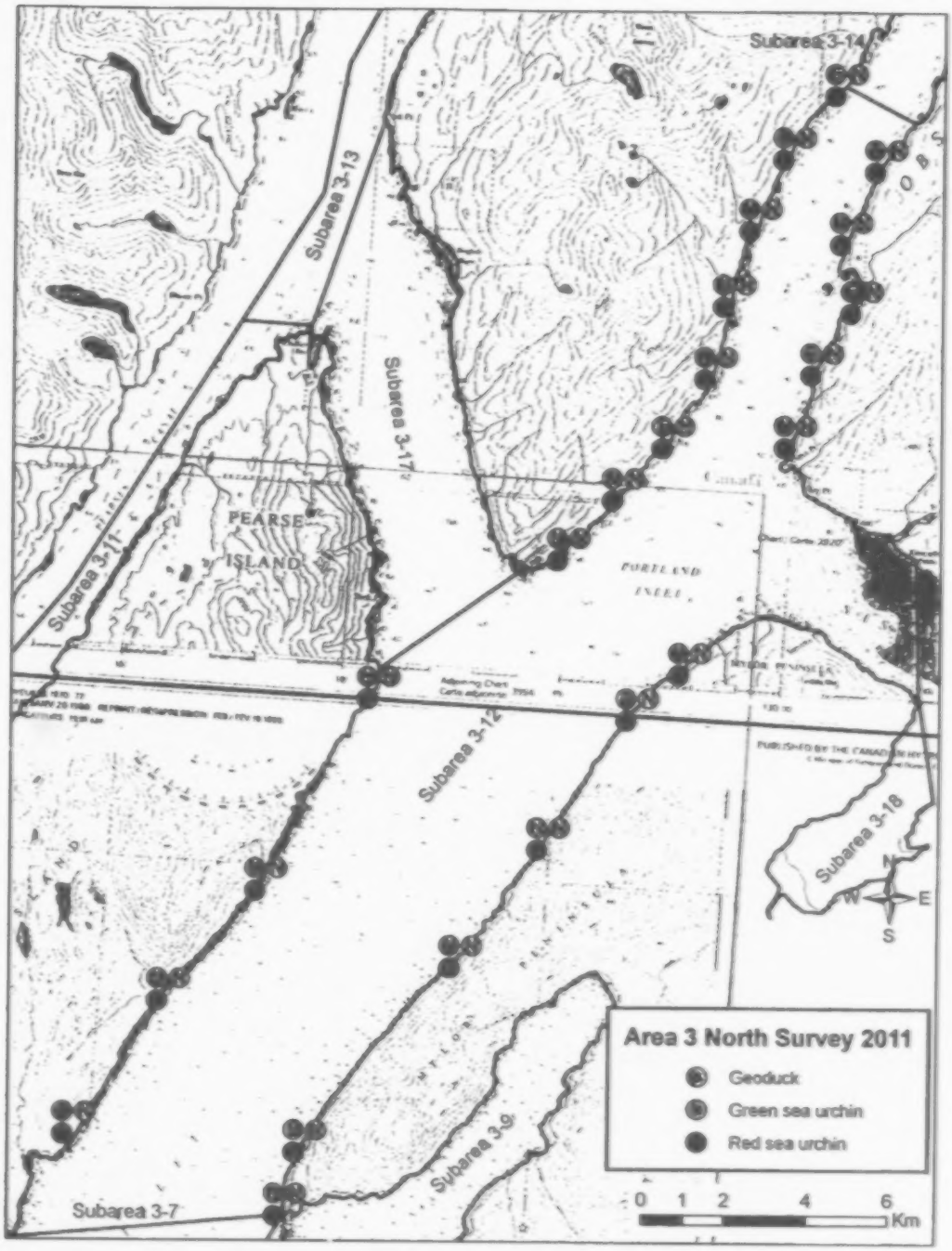

Figure 5. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 3–12. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

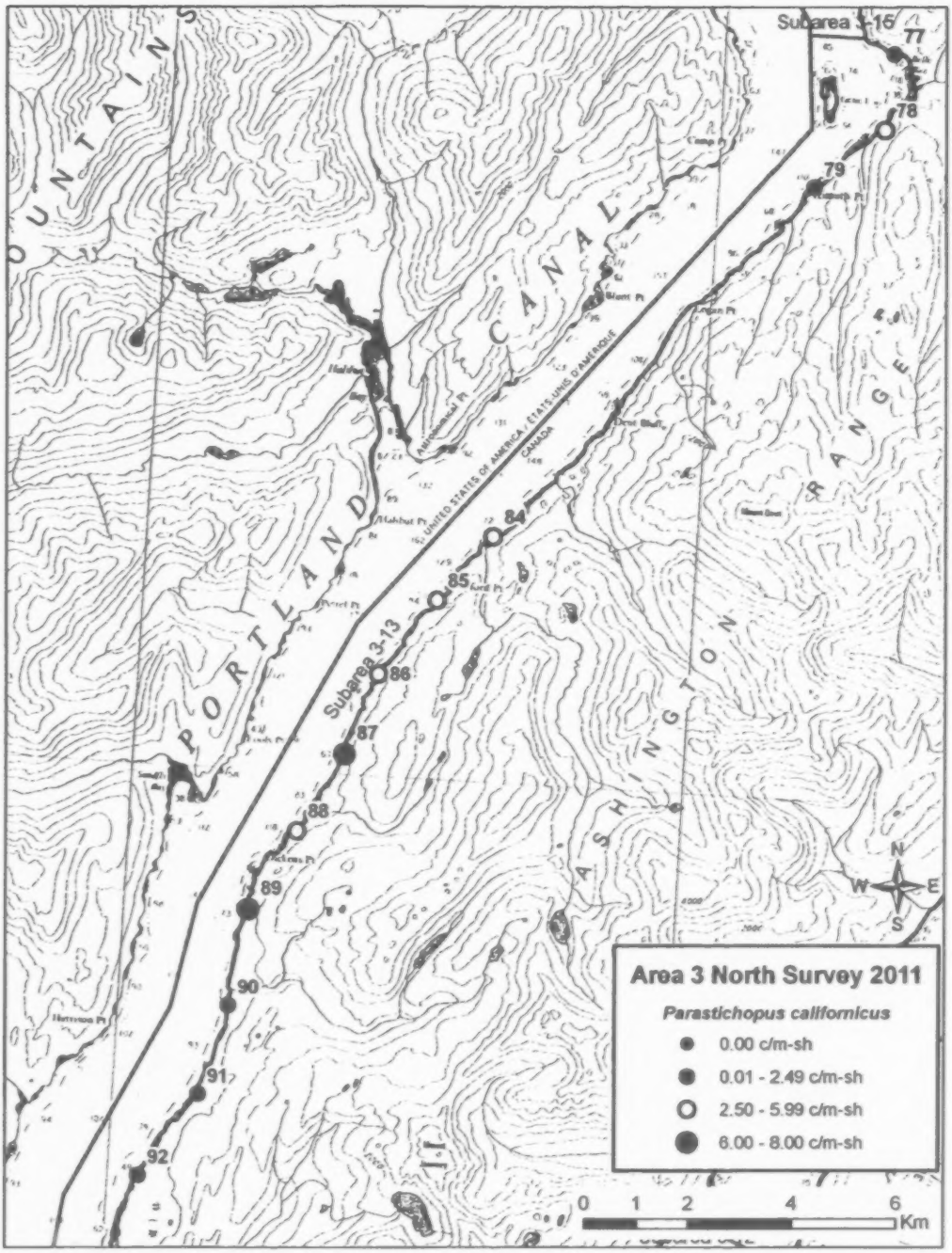

Figure 6. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in a portion of PFMA 3–13, surveyed as part of the Area 3 North survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 5.99 c/m-sh); green = productive locations (between 6.00 c/m-sh and the maximum observed density in the Subarea).

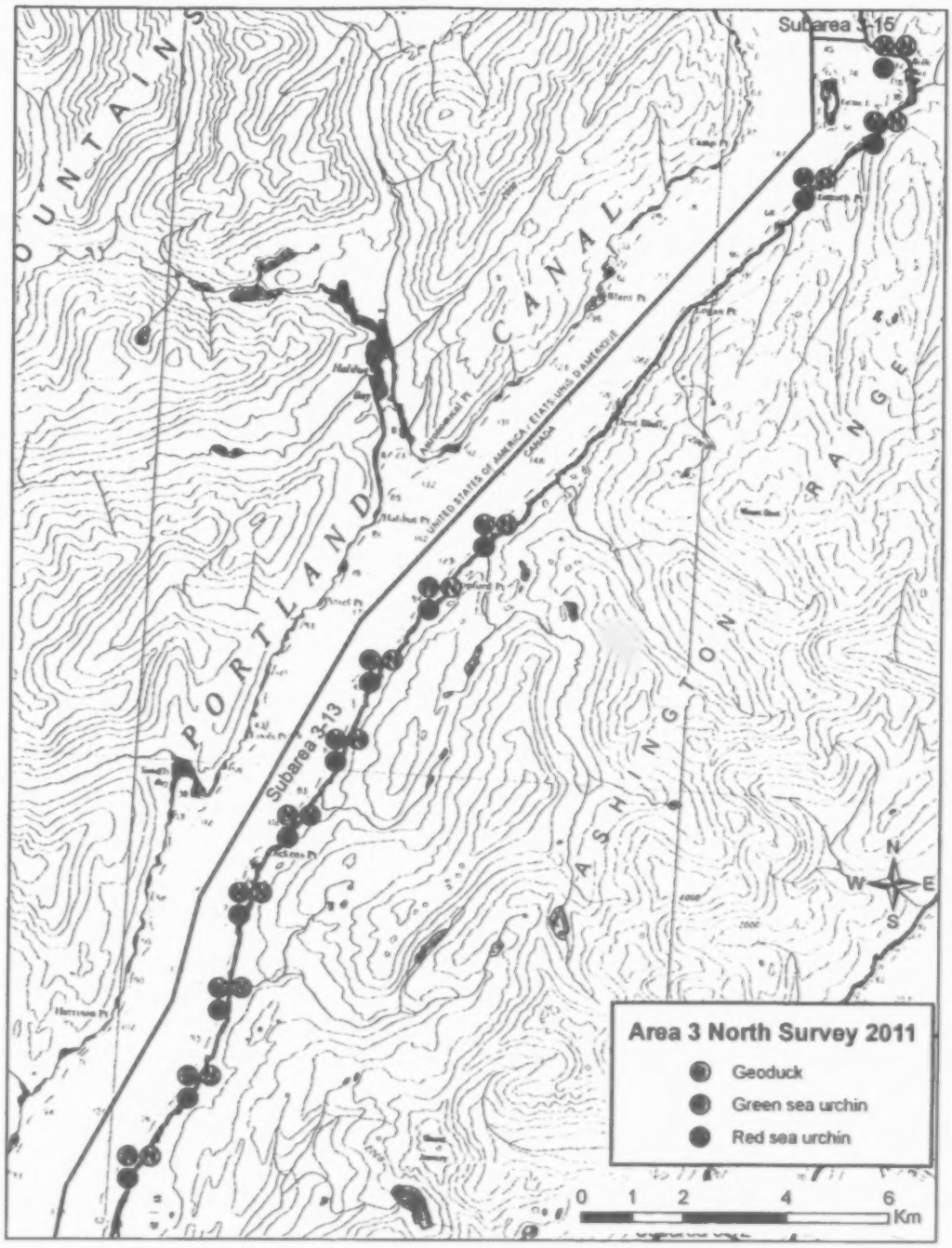

Figure 7. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in a portion of PFMA 3–13. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

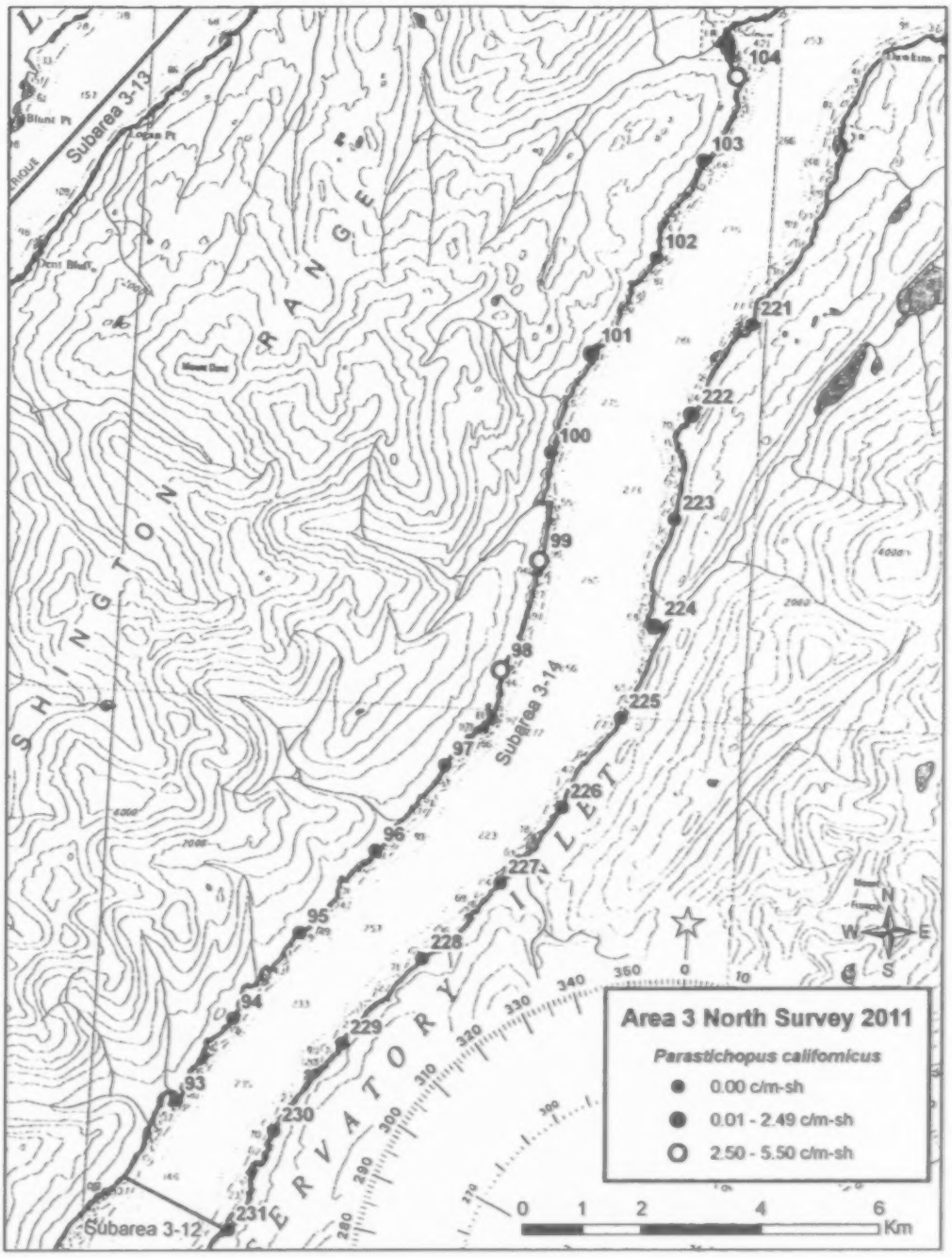

Figure 8. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in a portion of PFMA 3–14, surveyed as part of the Area 3 North survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.50 c/m-sh and the maximum observed density in the Subarea).

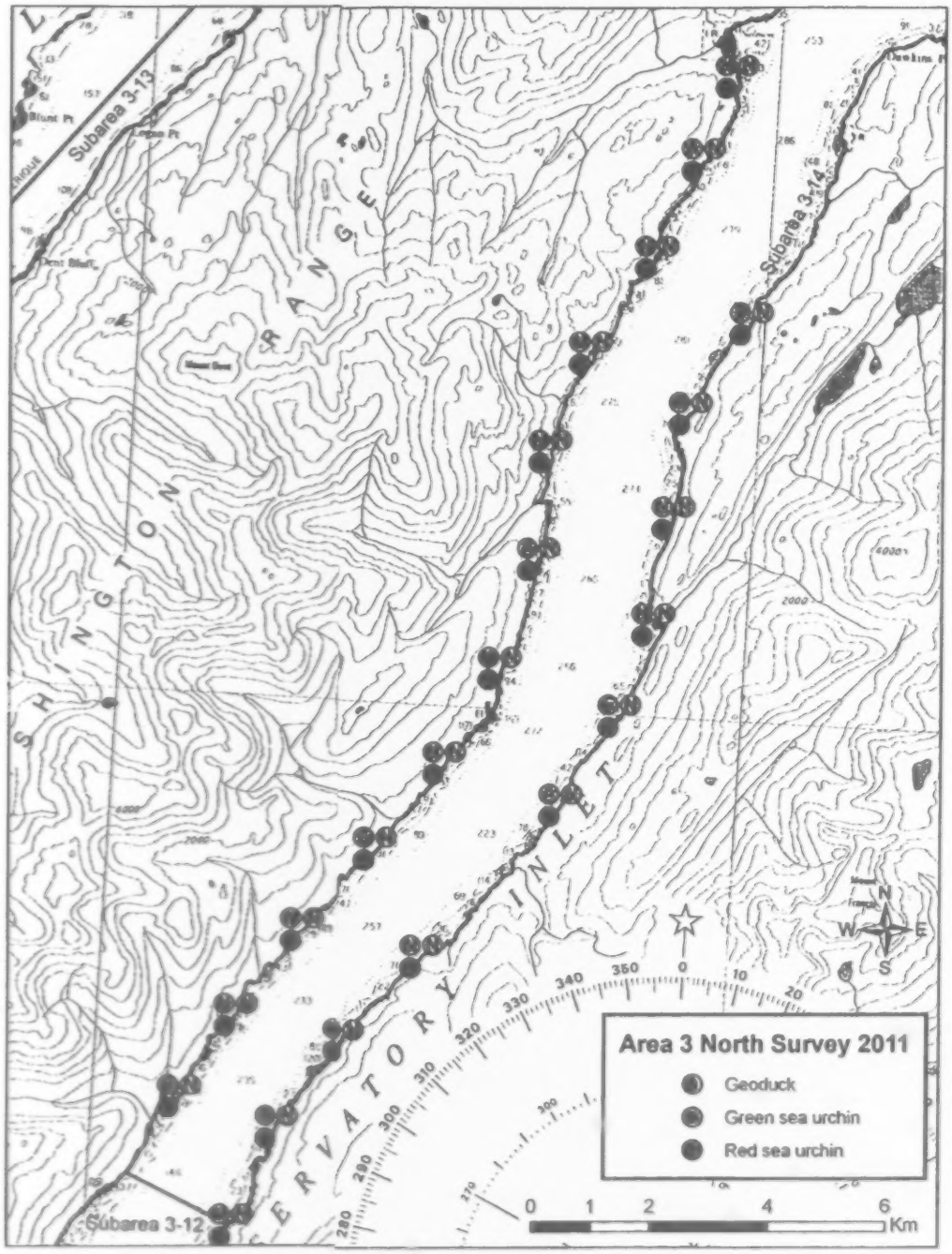

Figure 9. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 3–14. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

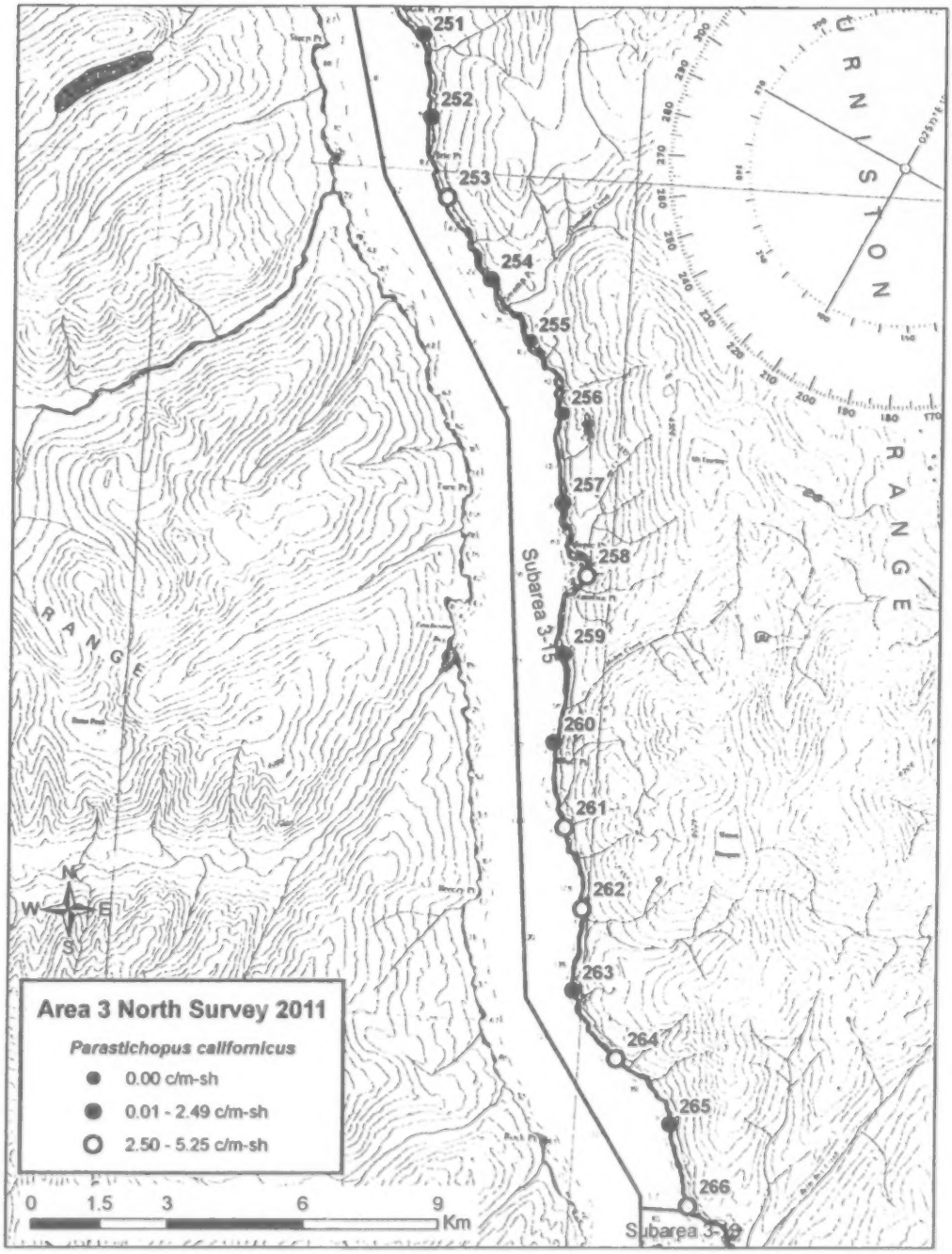

Figure 10a. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 3–15, surveyed as part of the Area 3 North survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.50 c/m-sh and the maximum observed density in the Subarea).

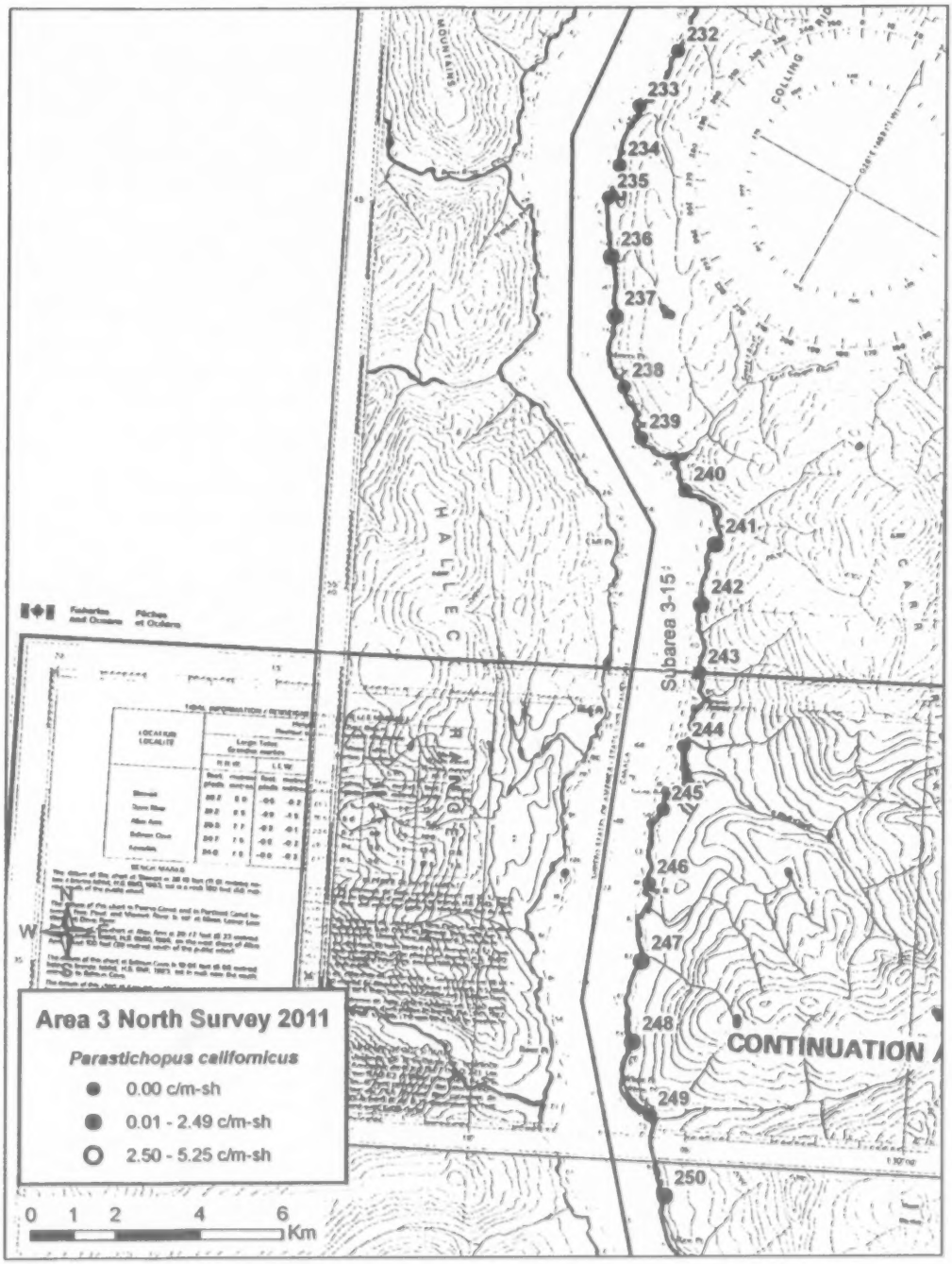

Figure 10b. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 3–15, surveyed as part of the Area 3 North survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.50 c/m-sh and the maximum observed density in the Subarea).

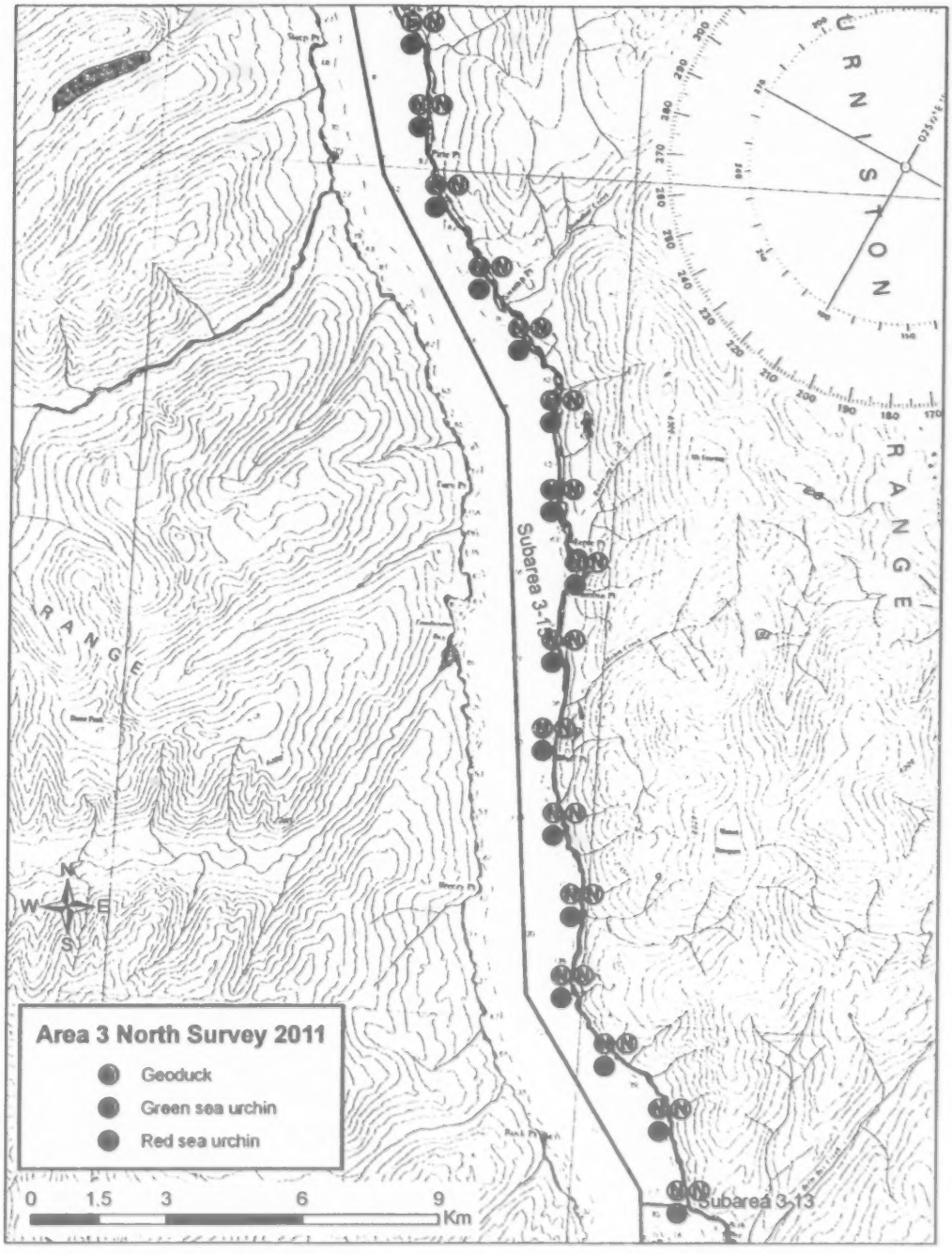

Figure 11a. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 3–15. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

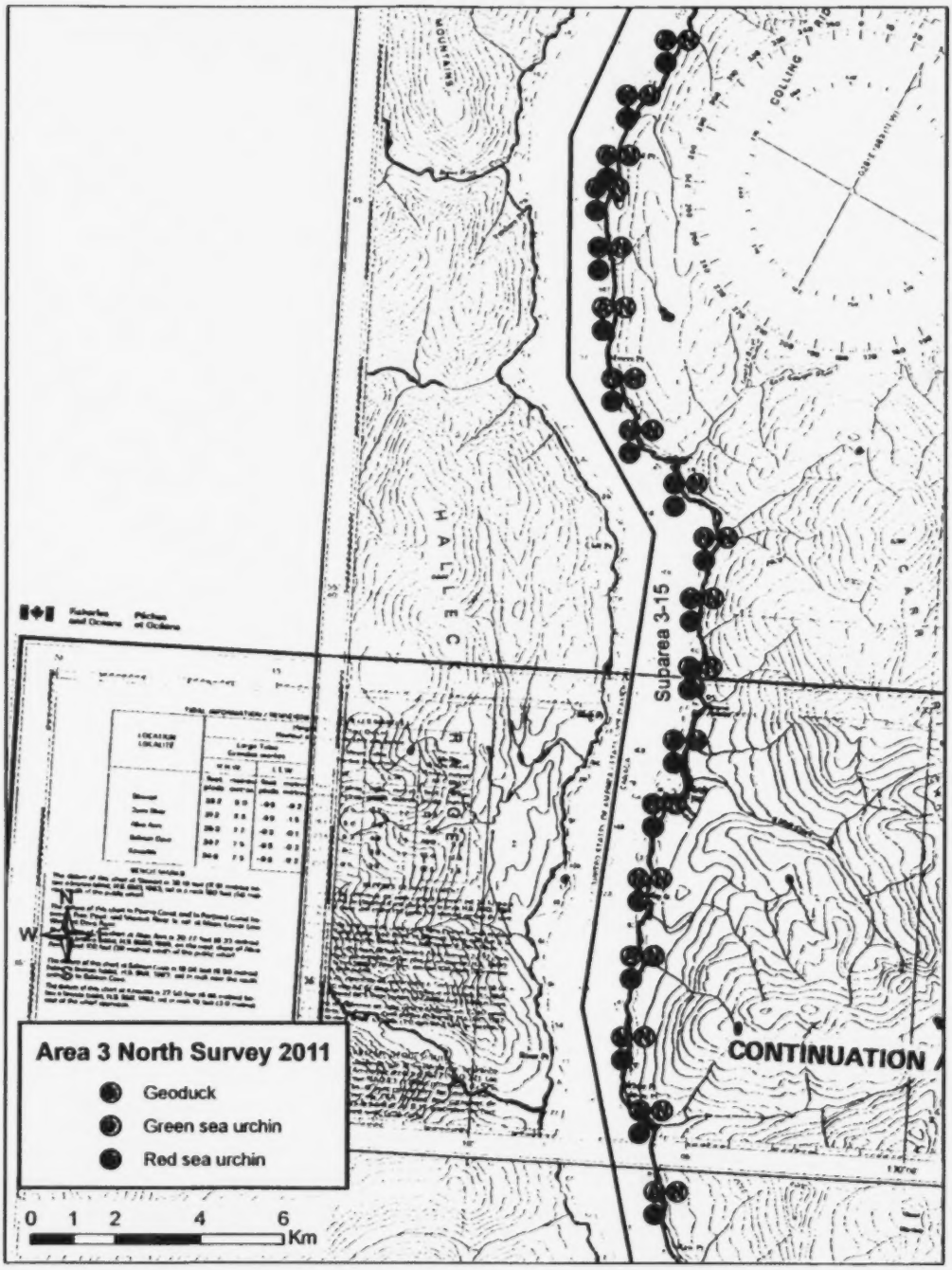

Figure 11b. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 3–15. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

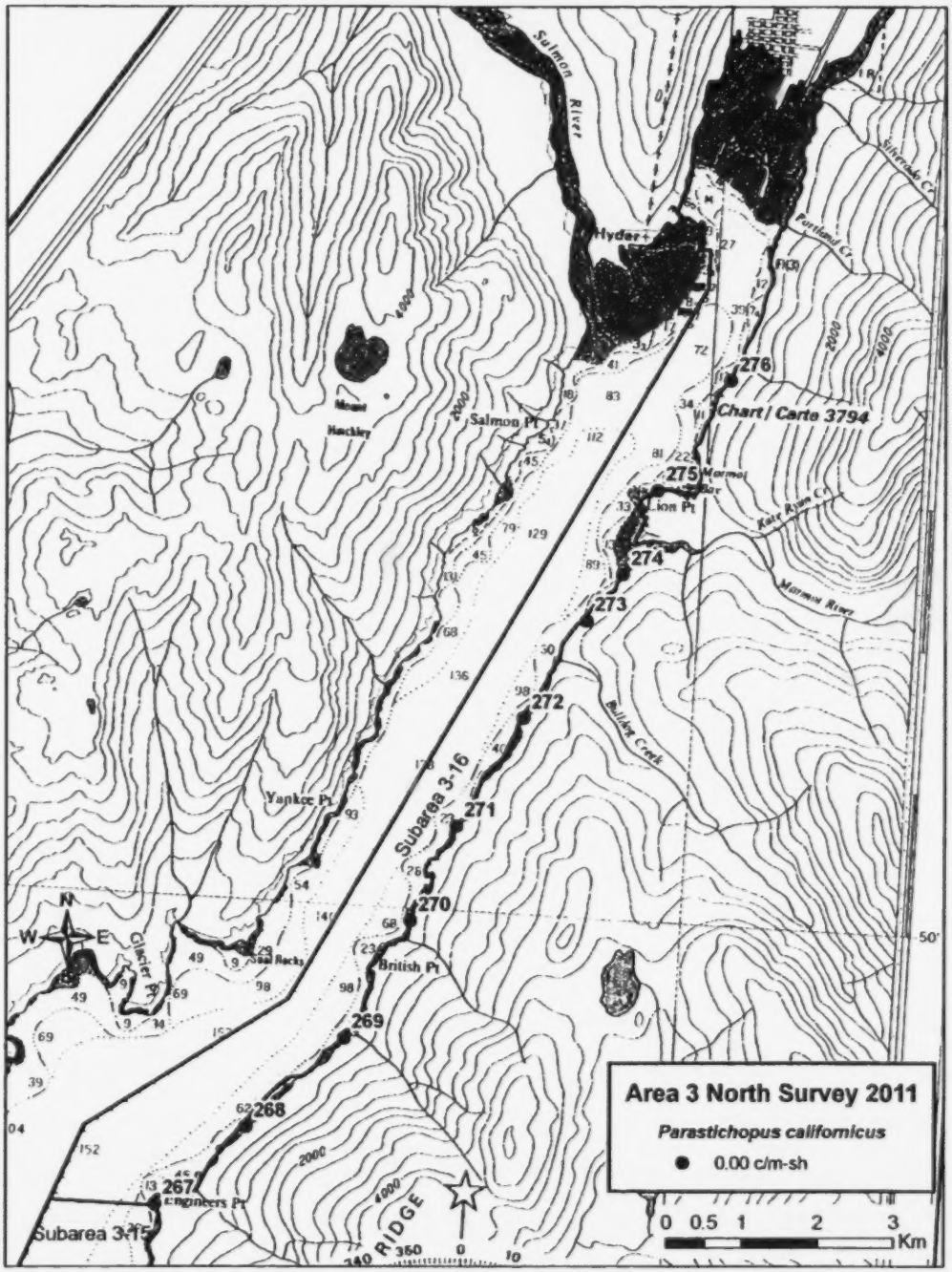

Figure 12. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 3–16, surveyed as part of the Area 3 North survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. No sea cucumbers were seen in this Subarea.

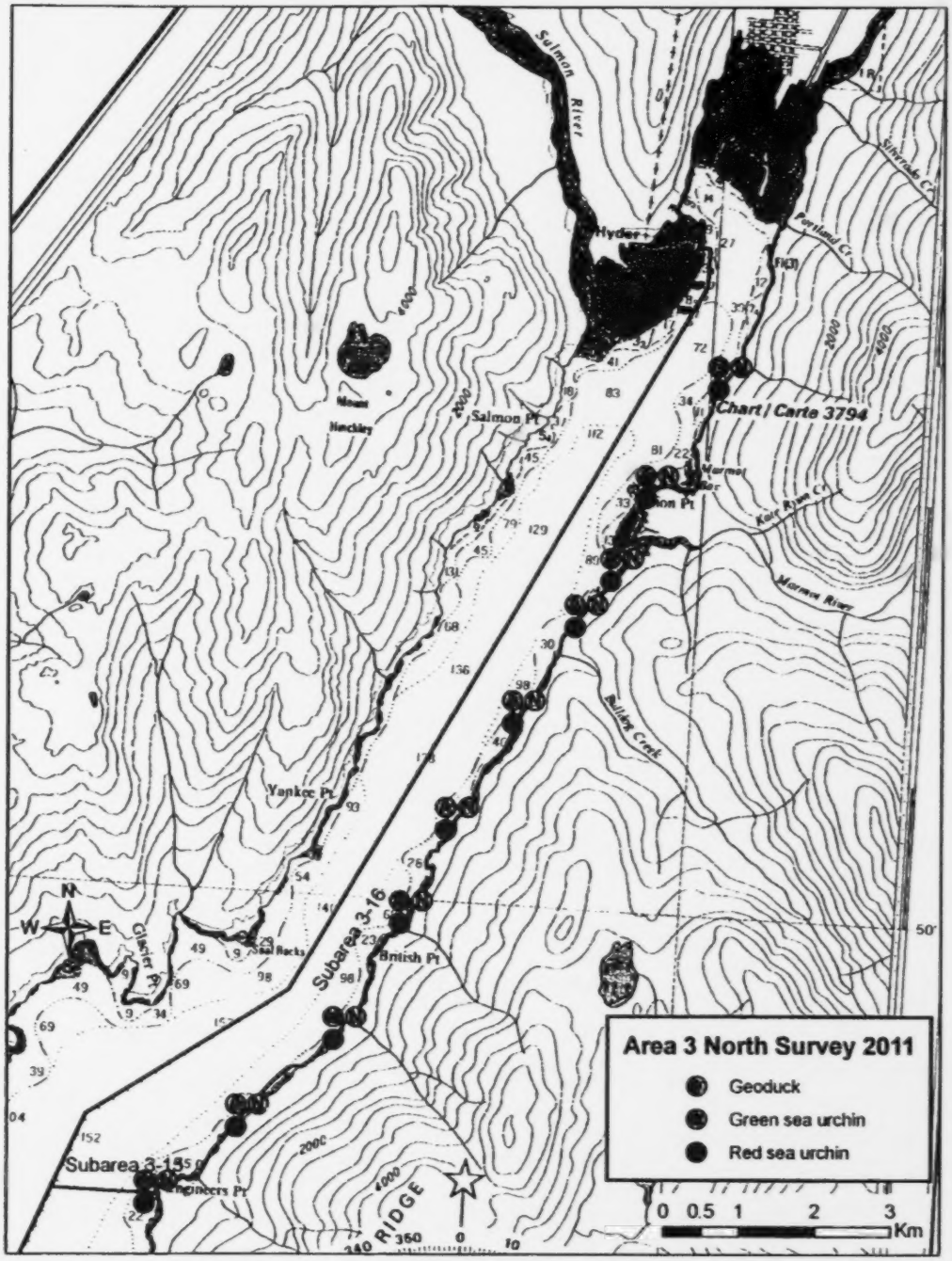

Figure 13. Abundances of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 3–16. The total number of animals observed while swimming the transect is noted and given an abundance scale of A, M, F, or 0. A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

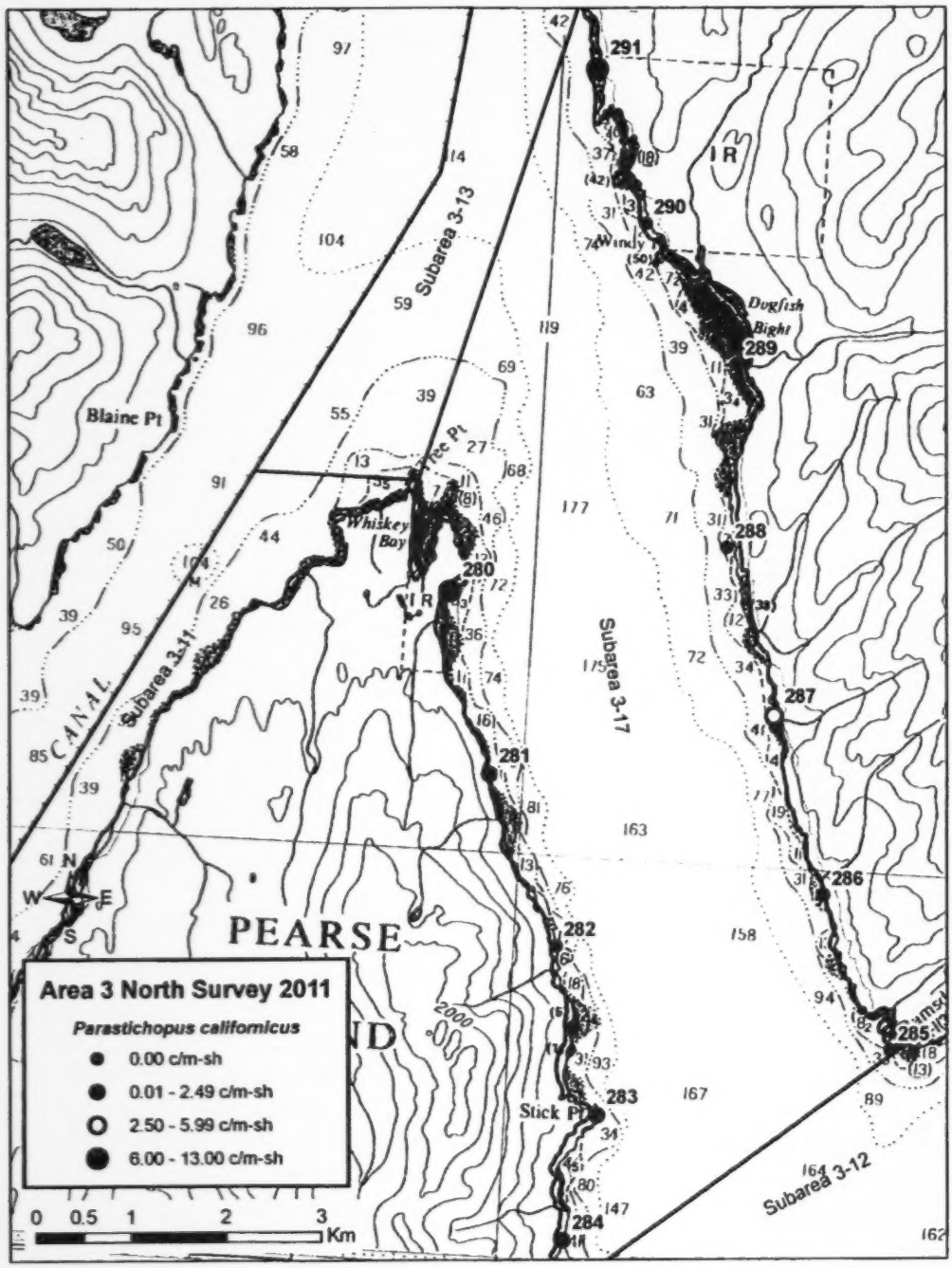

Figure 14. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 3–17, surveyed as part of the Area 3 North survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 5.99 c/m-sh); green = productive locations (between 6.00 c/m-sh and the maximum observed density in the Subarea).

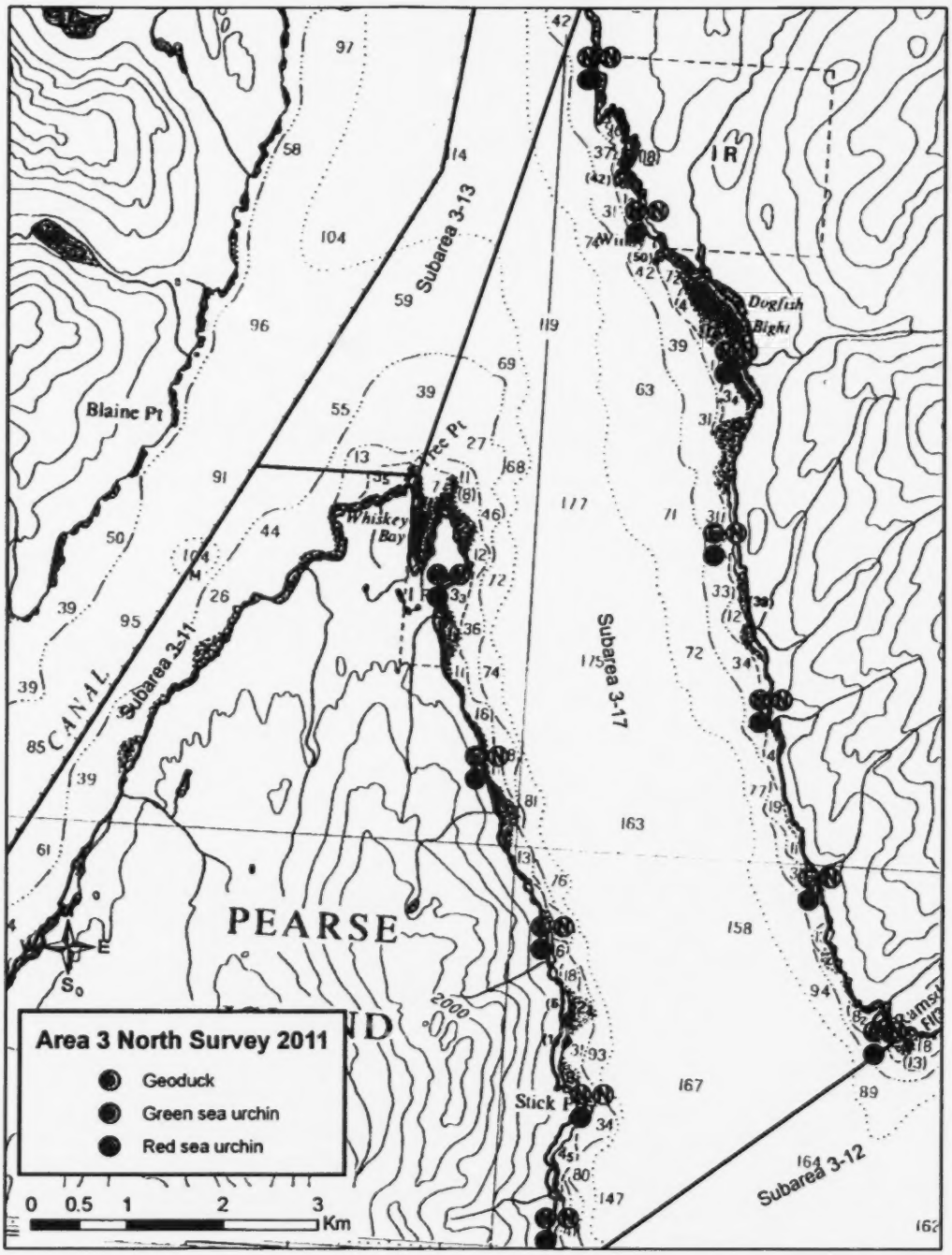

Figure 15. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 3–17. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

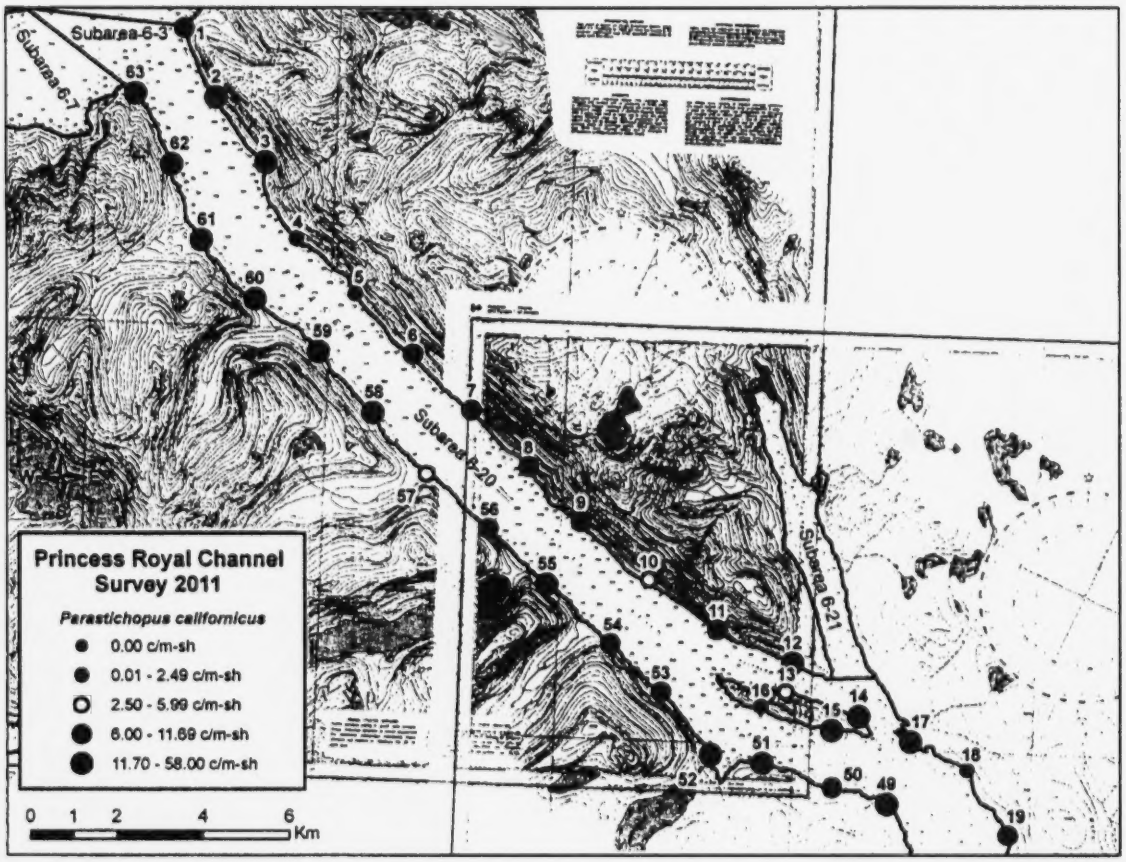

Figure 16a. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in a portion of PFMA 6–20, surveyed as part of the Princess Royal Channel survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 5.99 c/m-sh); green = productive locations (between 6.00 c/m-sh and the bootstrapped lower 90% confidence bound calculated for the Subarea); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

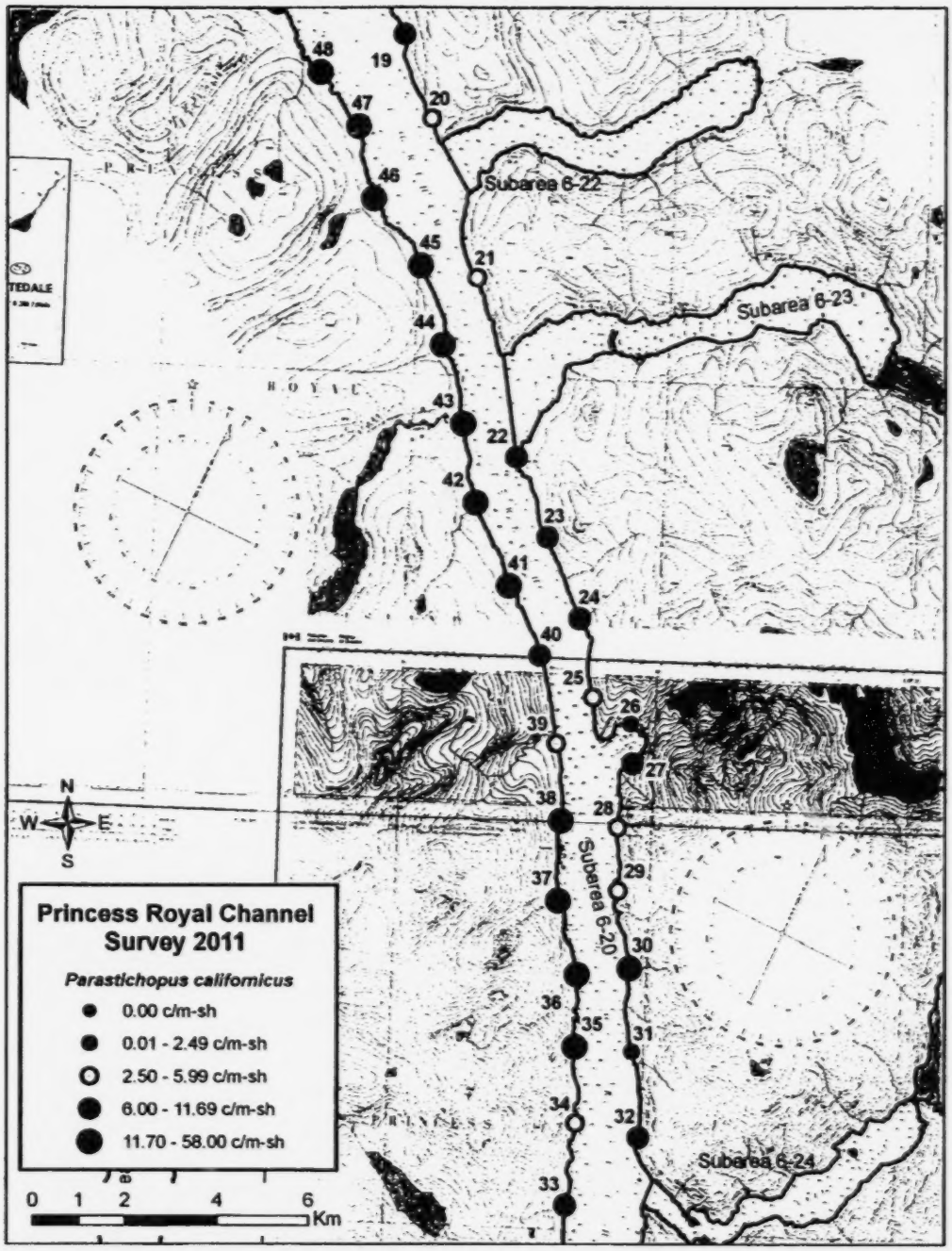

Figure 16b. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in a portion of PFMA 6–20, surveyed as part of the Princess Royal Channel survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 5.99 c/m-sh); green = productive locations (between 6.00 c/m-sh and the bootstrapped lower 90% confidence bound calculated for the Subarea); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

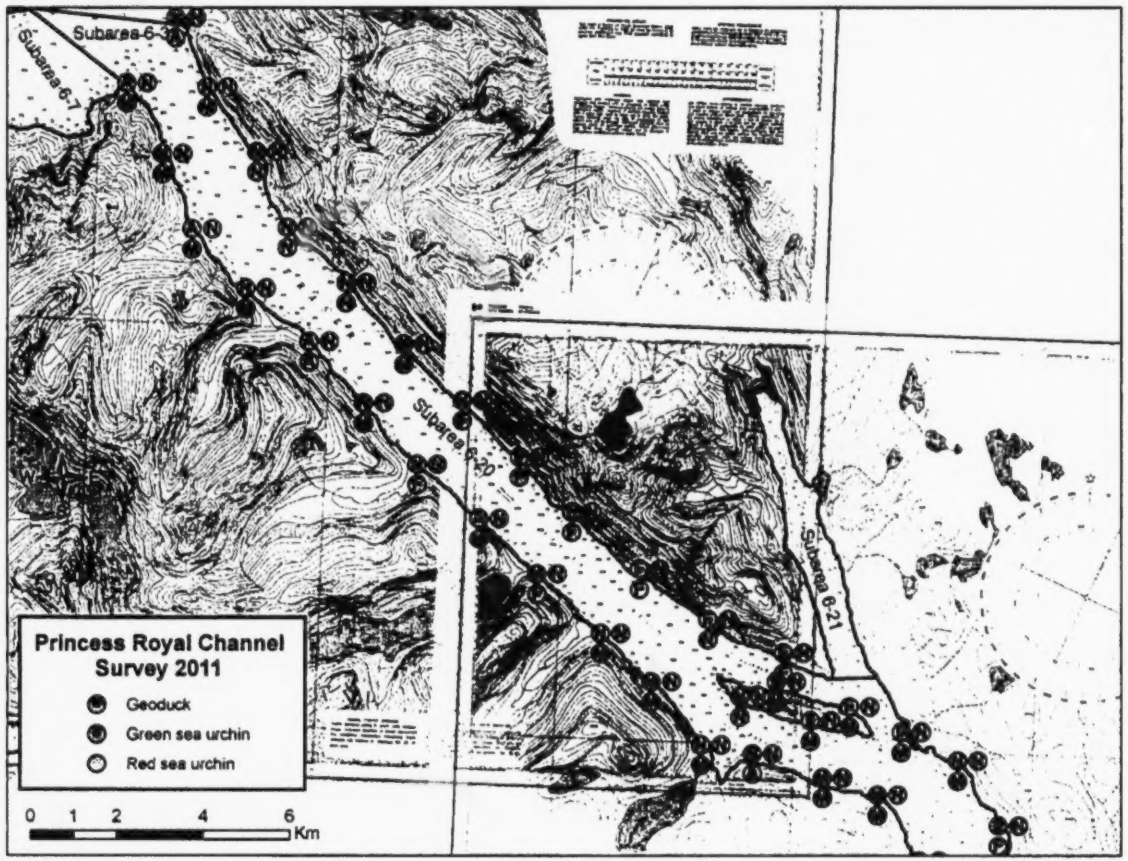

Figure 17a. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 6–20. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

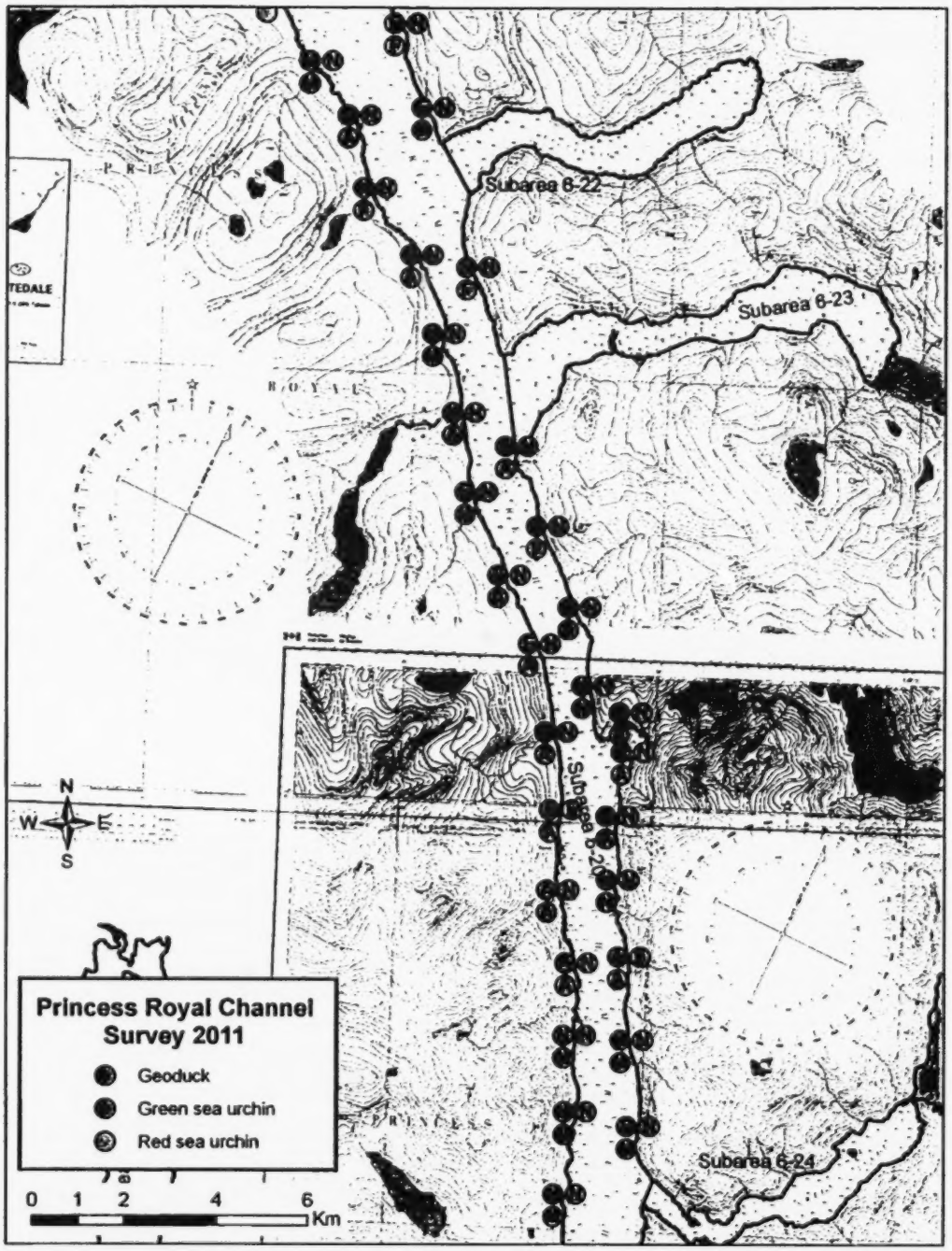

Figure 17b. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 6–20. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

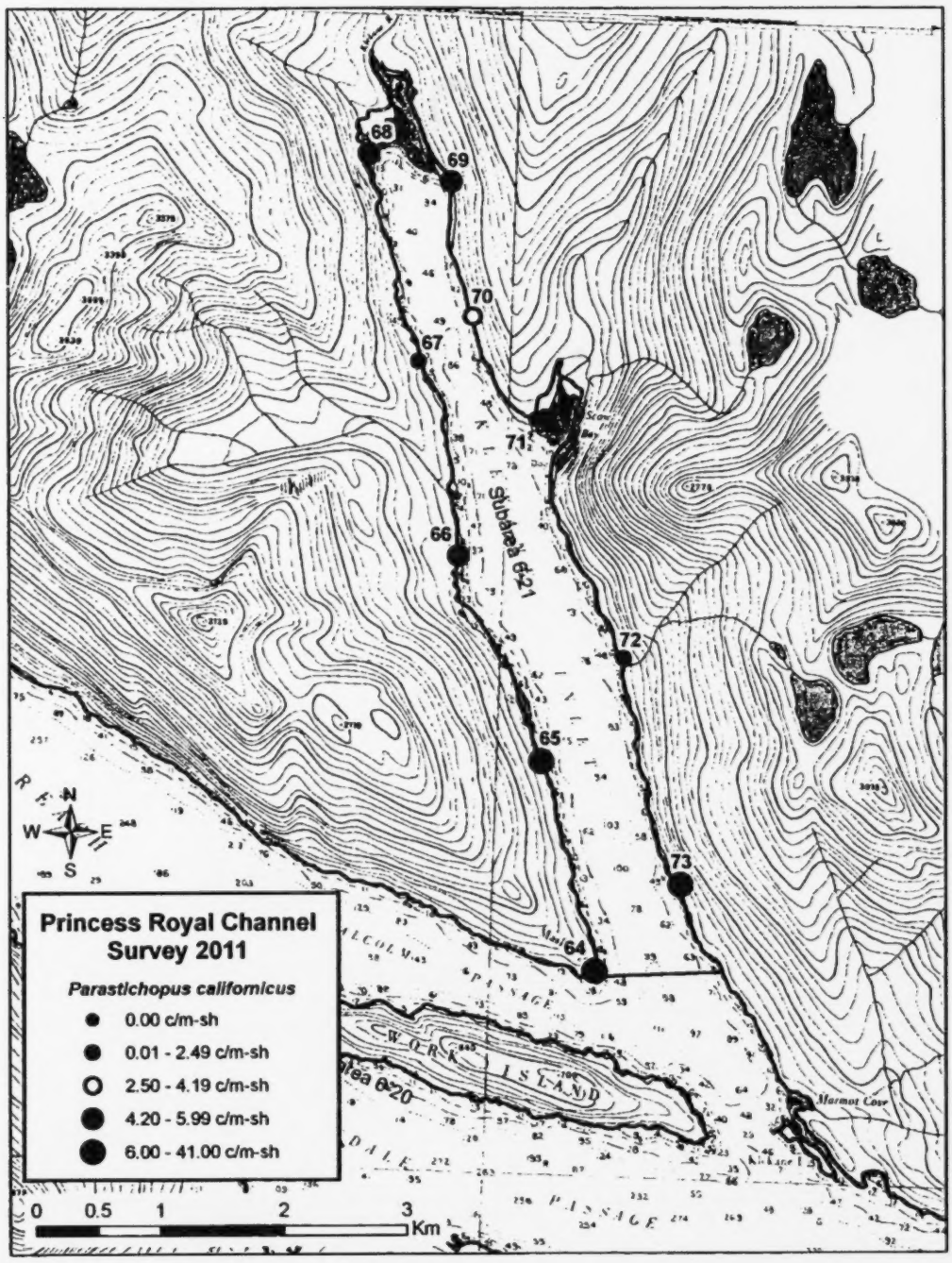

Figure 18. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 6–21, surveyed as part of the Princess Royal Channel survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.19 c/m-sh); green = productive locations (between the bootstrapped lower 90% confidence bound calculated for the Subarea and 5.99 c/m-sh); blue = very productive locations (densities above the North Coast regional baseline density).

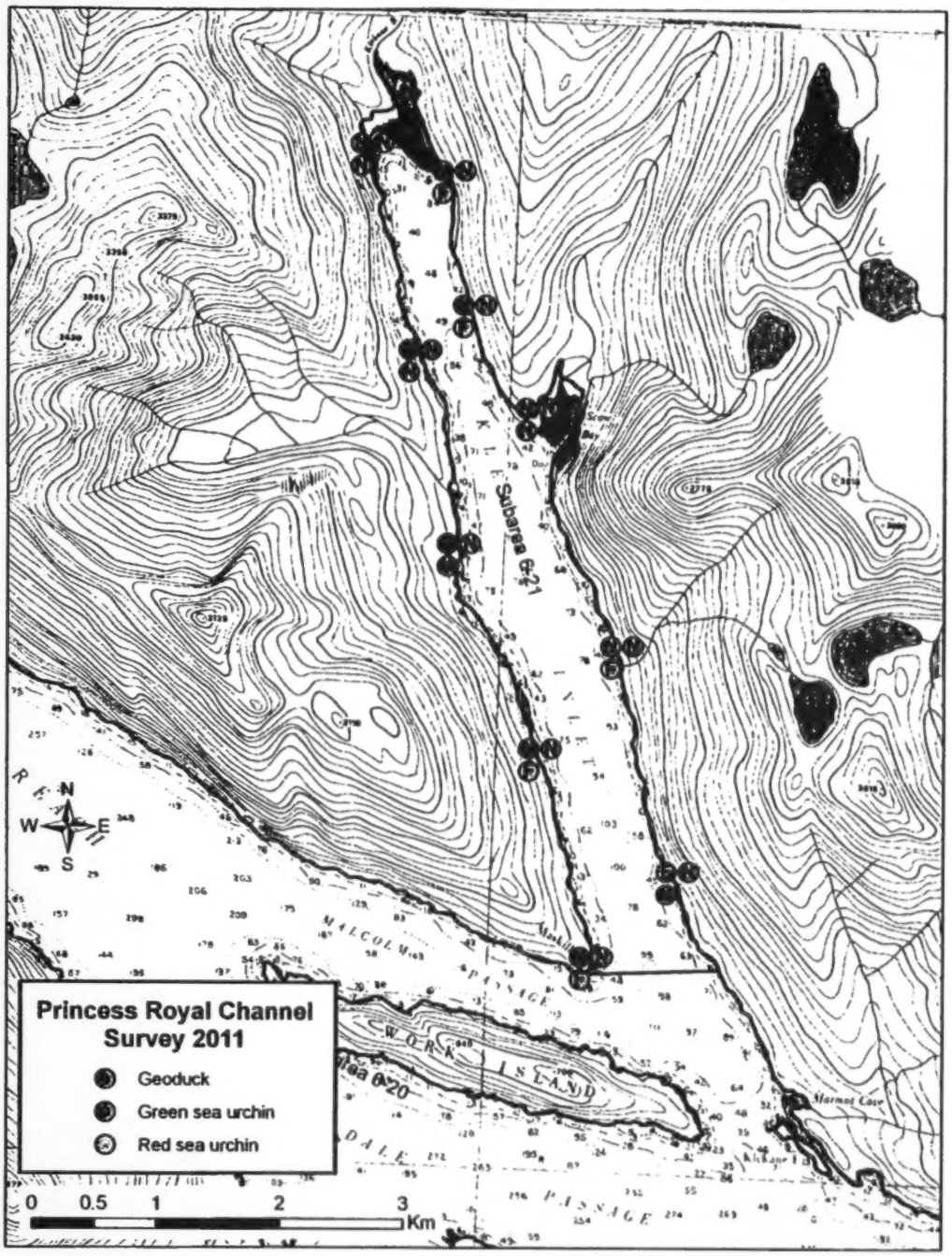

Figure 19. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 6–21. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

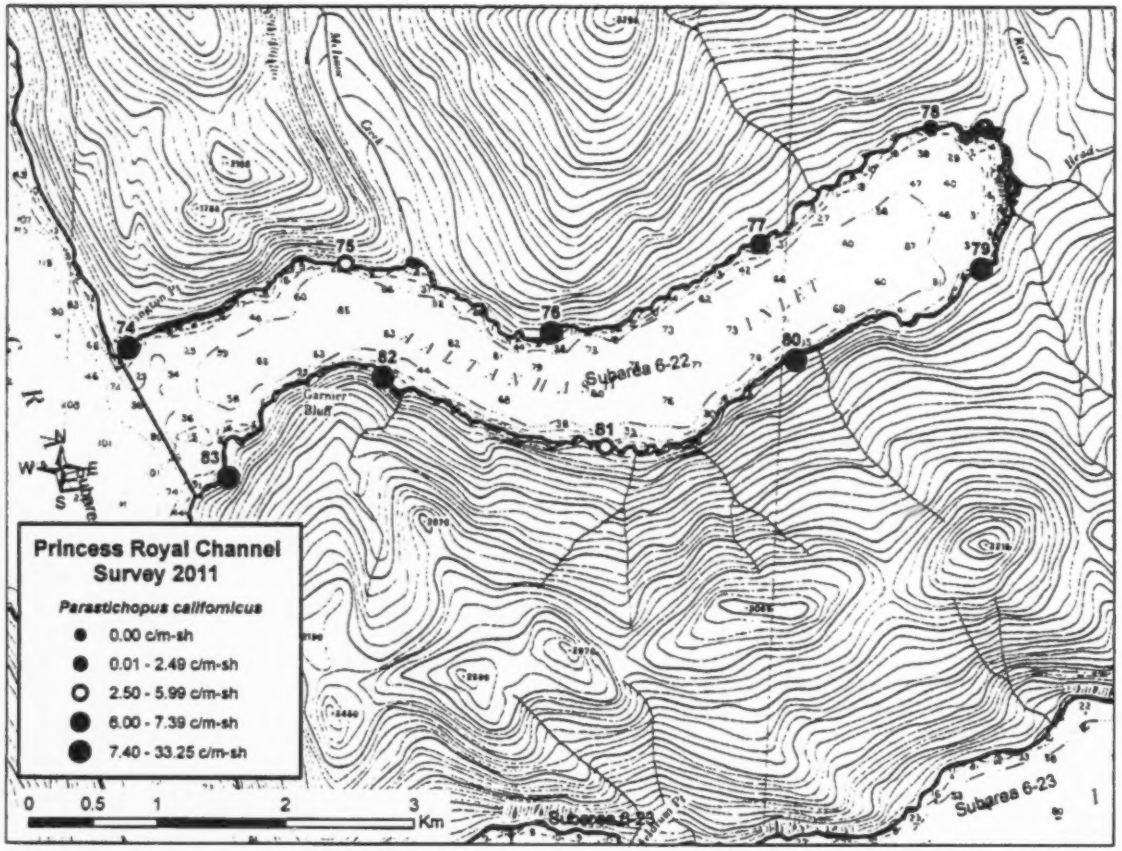

Figure 20. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 6–22, surveyed as part of the Princess Royal Channel survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 5.99 c/m-sh); green = productive locations (between the North Coast regional baseline density and 7.39 c/m-sh); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

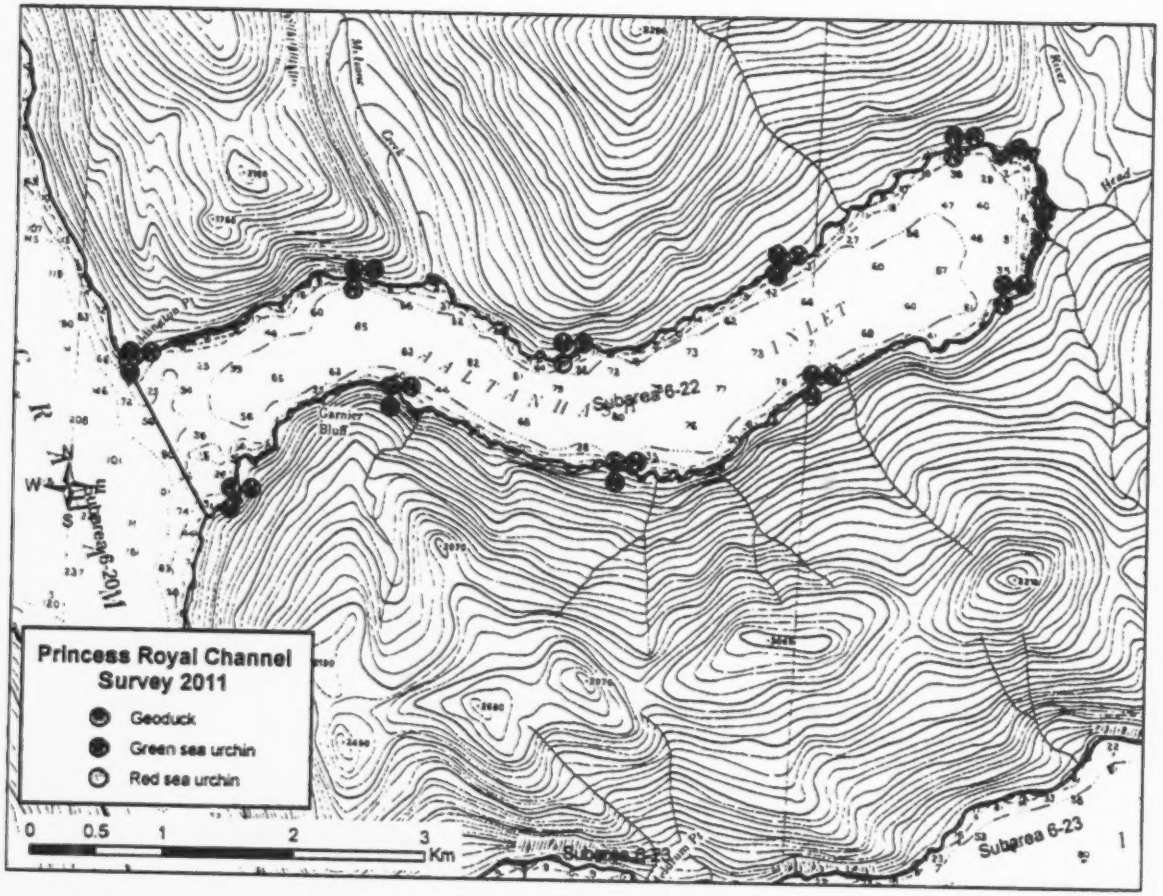

Figure 21. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 6–22. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

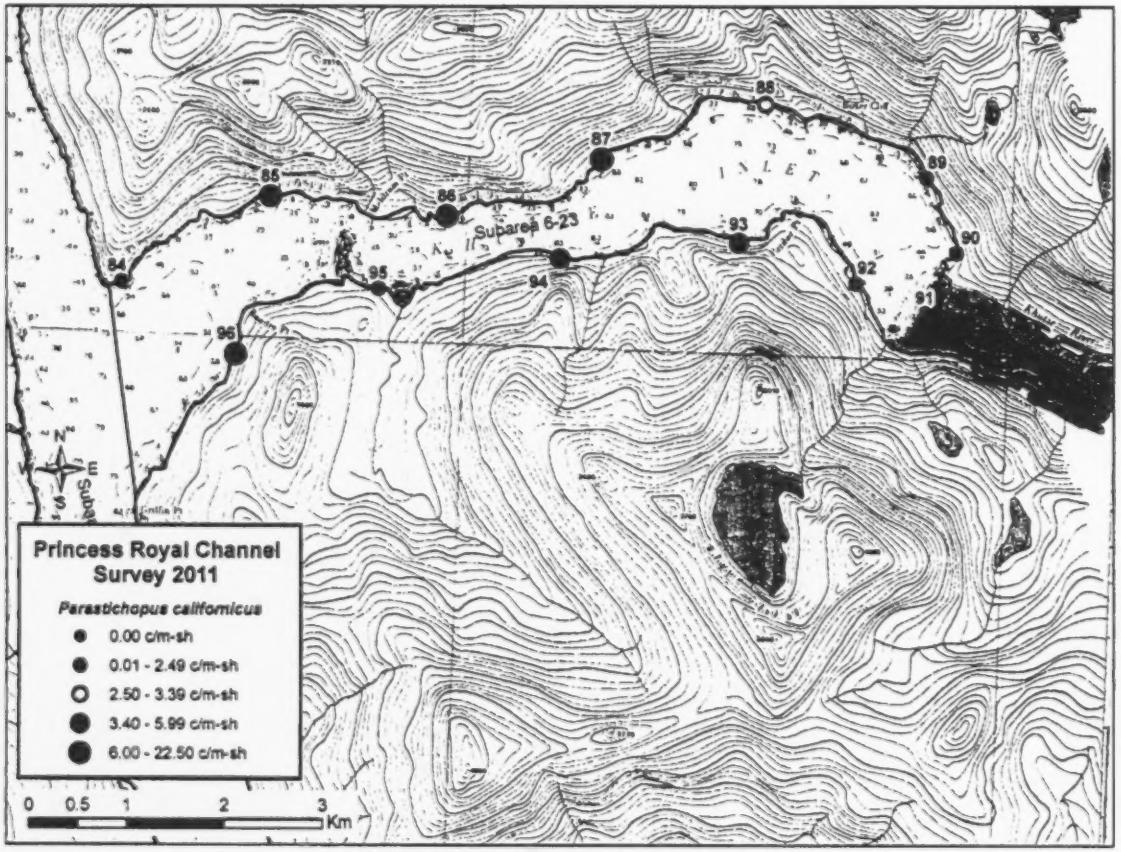

Figure 22. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 6–23, surveyed as part of the Princess Royal Channel survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 3.39 c/m-sh); green = productive locations (between the bootstrapped lower 90% confidence bound calculated for the Subarea and 5.99 c/m-sh); blue = very productive locations (densities above the North Coast regional baseline density).

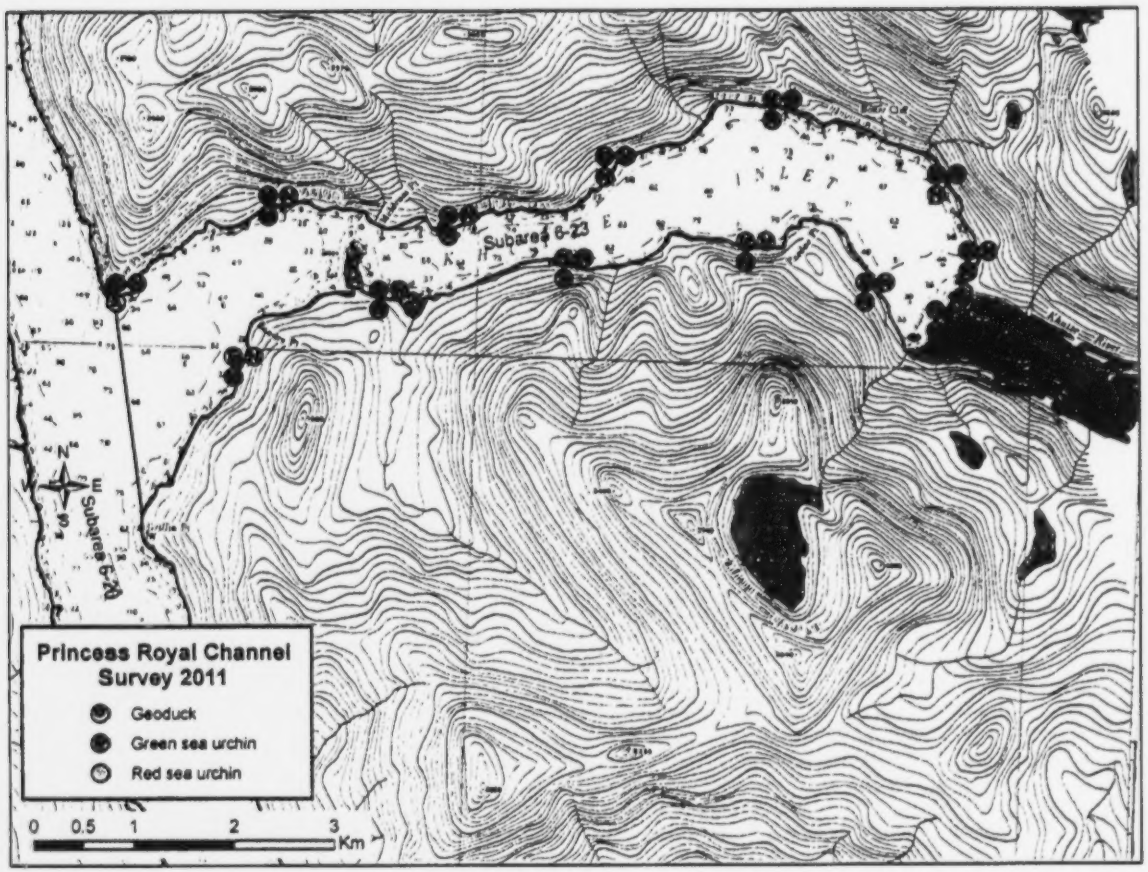

Figure 23. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in a portion of PFMA 6–23. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

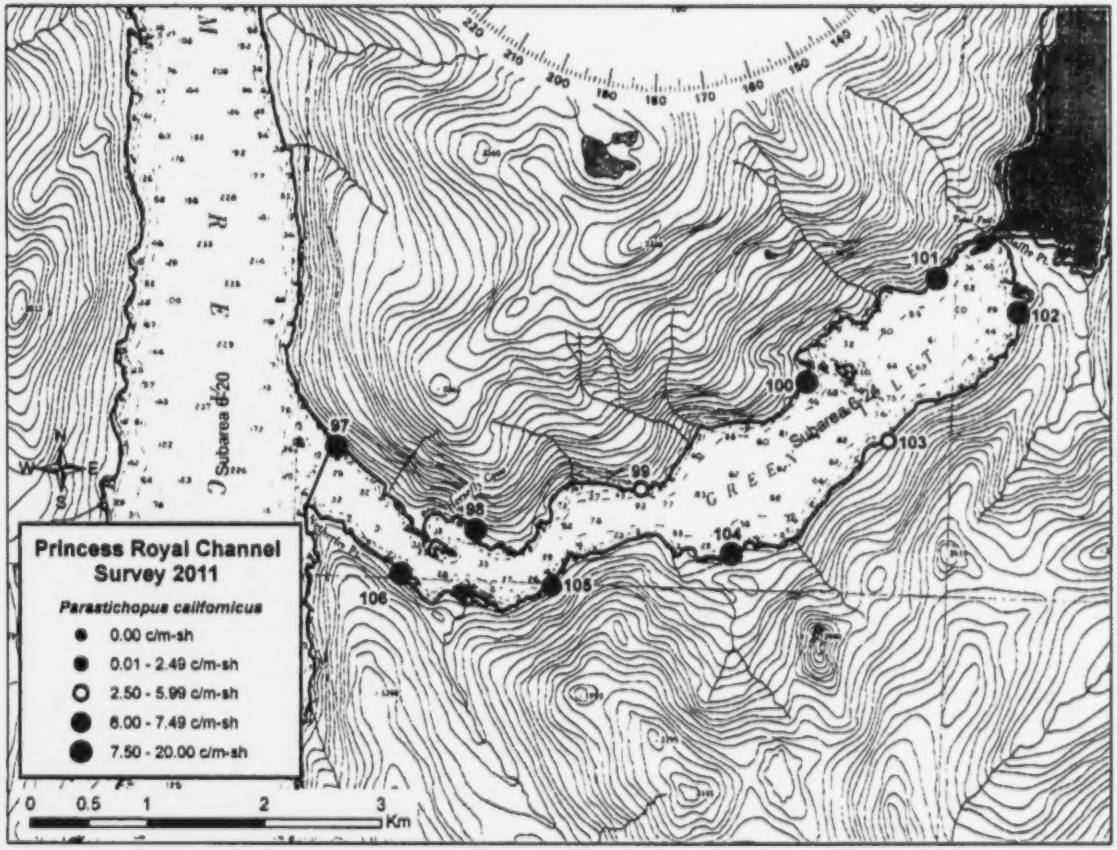

Figure 24. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 6–24, surveyed as part of the Princess Royal Channel survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 5.99 c/m-sh); green = productive locations (between the North Coast regional baseline density and 7.49 c/m-sh); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

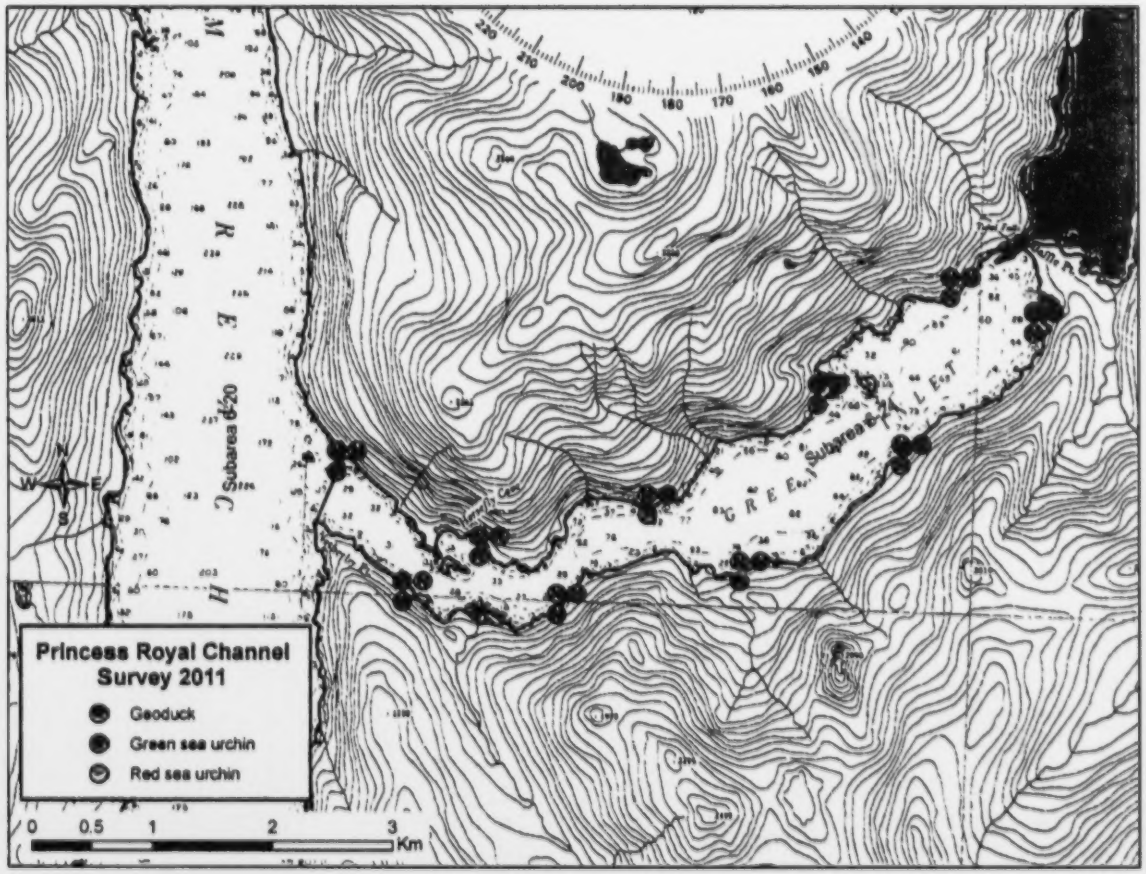

Figure 25. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 6–24. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

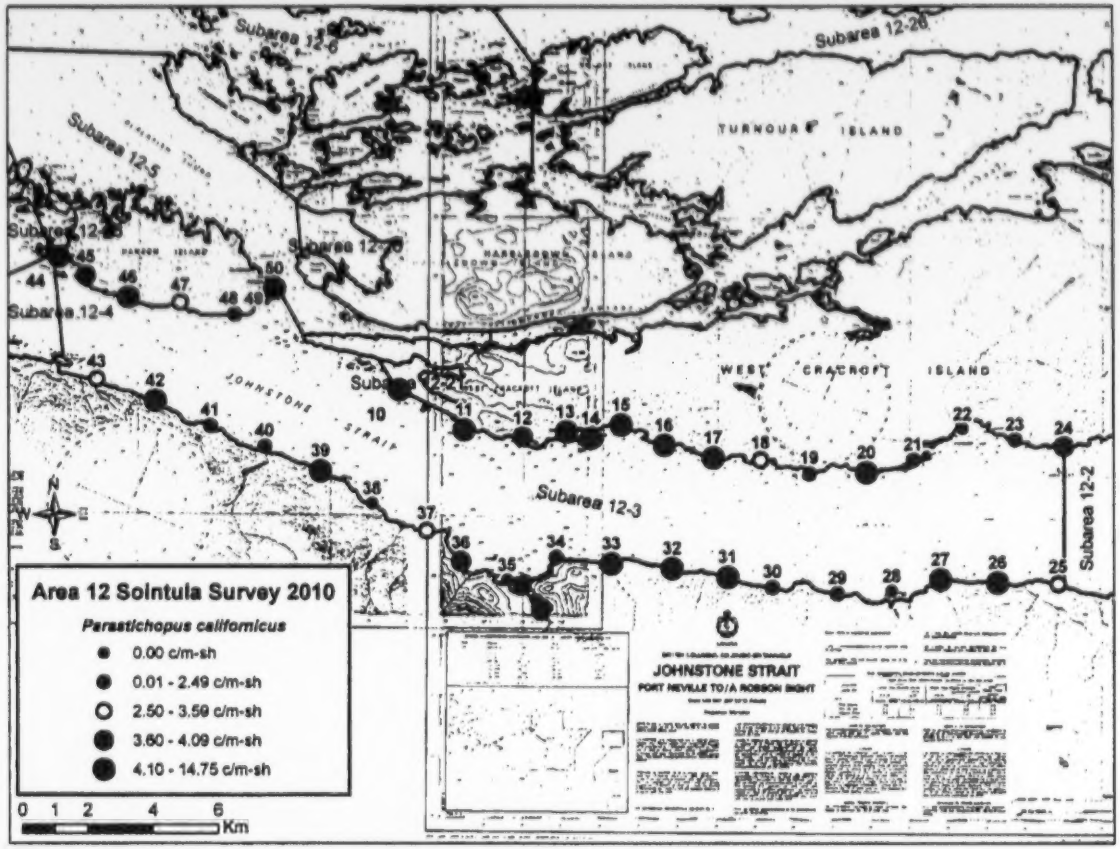

Figure 26a. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 12–3, surveyed as part of the Area 12 Sointula survey in 2010. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 3.59 c/m-sh); green = productive locations (between the bootstrapped lower 90% confidence bound calculated for the Subarea and 4.09 c/m-sh); blue = very productive locations (densities above East Coast Vancouver Island regional baseline density).

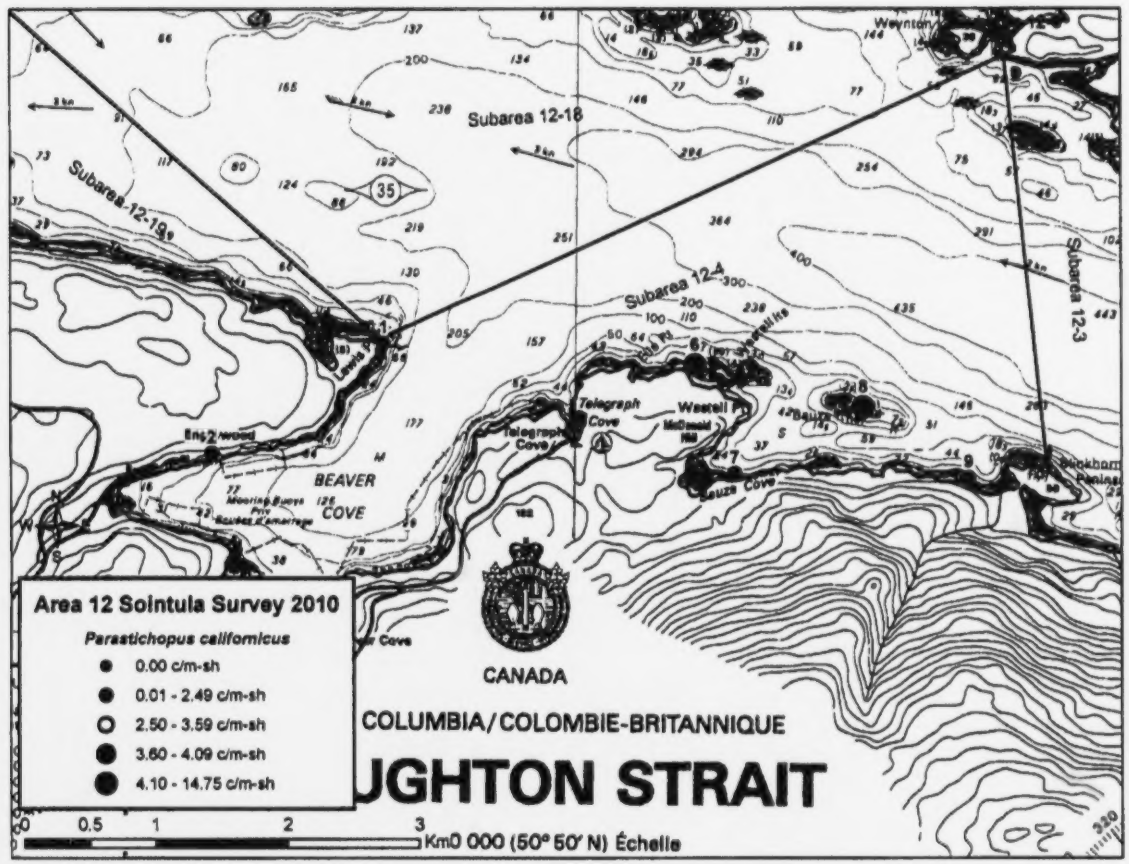

Figure 26b. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 12–4, surveyed as part of the Area 12 Sointula survey in 2010. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 3.59 c/m-sh); green = productive locations (between the bootstrapped lower 90% confidence bound calculated for the Subarea and 4.09 c/m-sh); blue = very productive locations (densities above East Coast Vancouver Island regional baseline density).

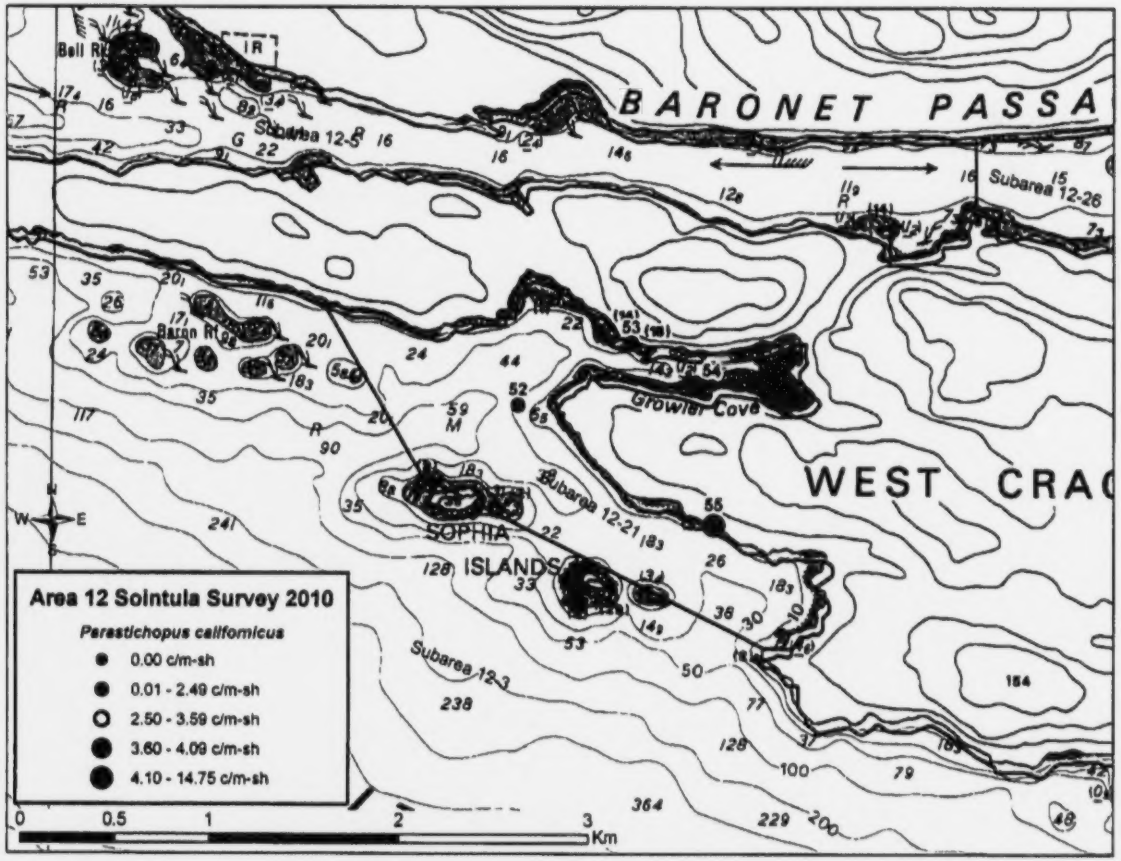

Figure 26c. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 12–21, surveyed as part of the Area 12 Sointula survey in 2010. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 3.59 c/m-sh); green = productive locations (between the bootstrapped lower 90% confidence bound calculated for the Subarea and 4.09 c/m-sh); blue = very productive locations (densities above East Coast Vancouver Island regional baseline density).

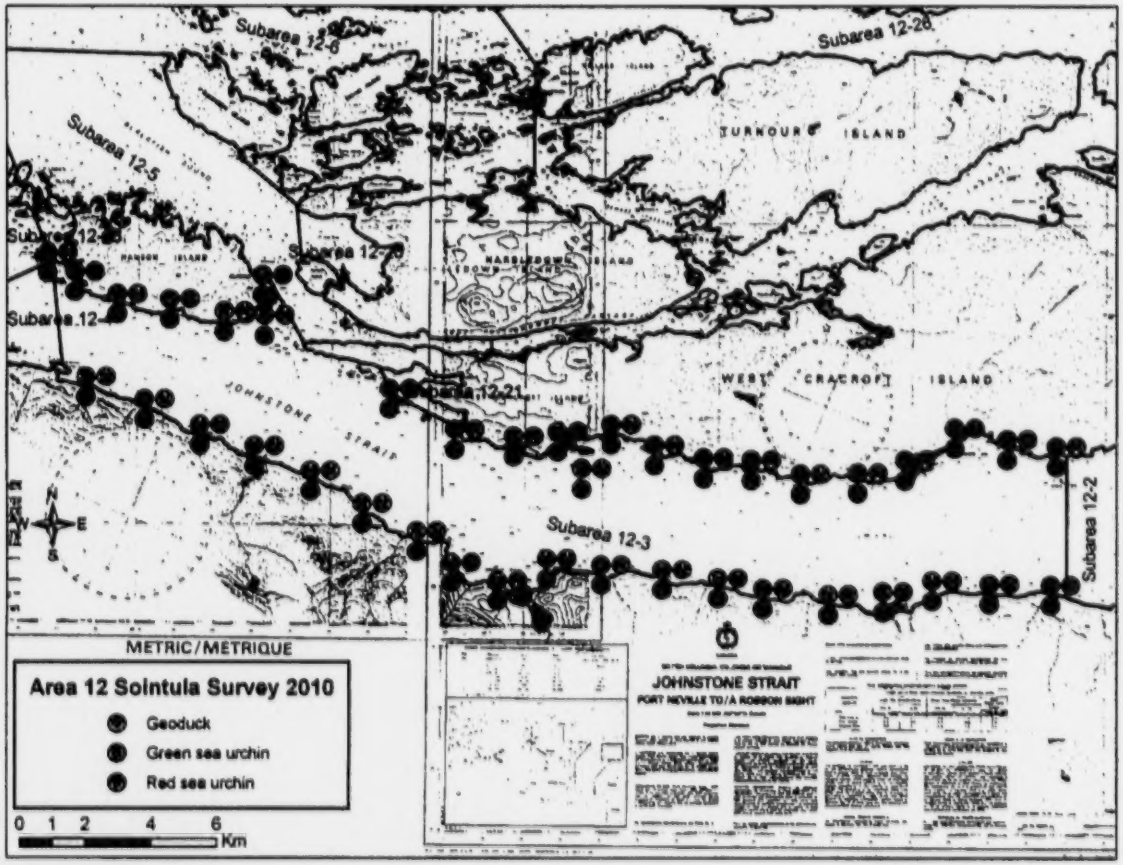

Figure 27a. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 12–3. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

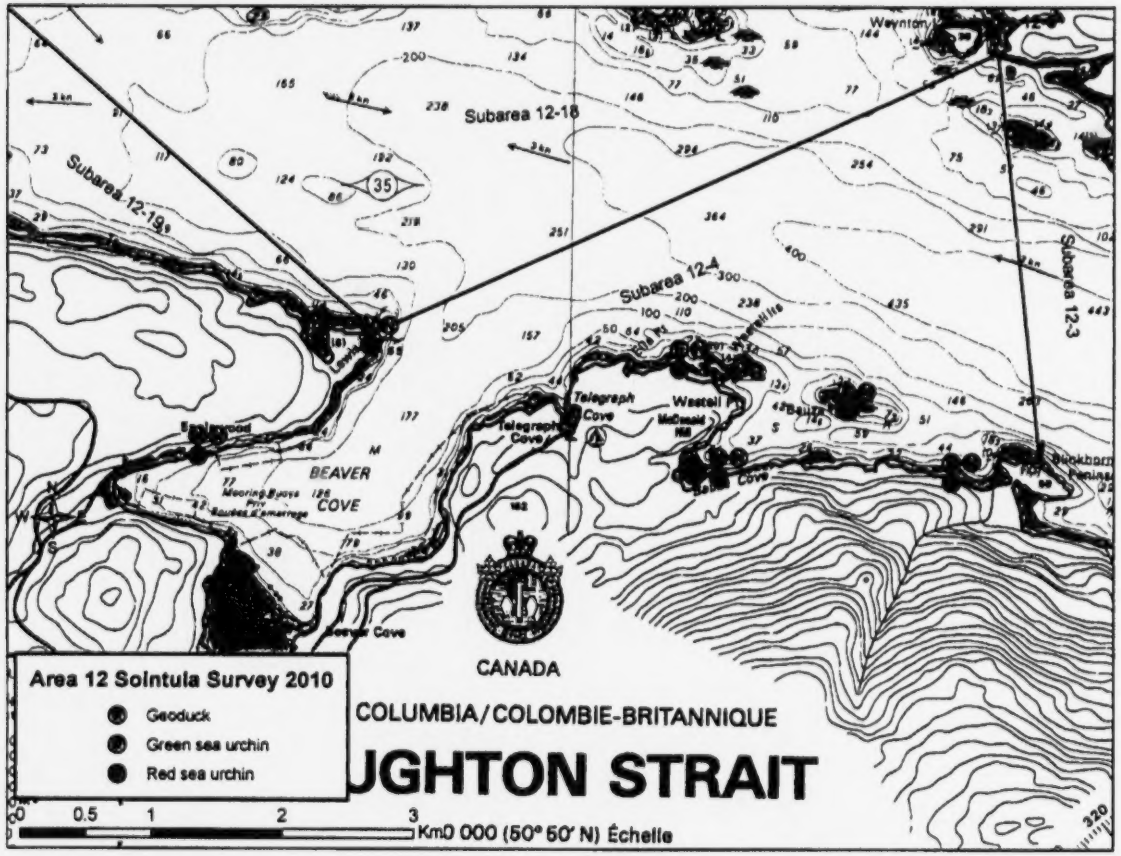

Figure 27b. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 12–4. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

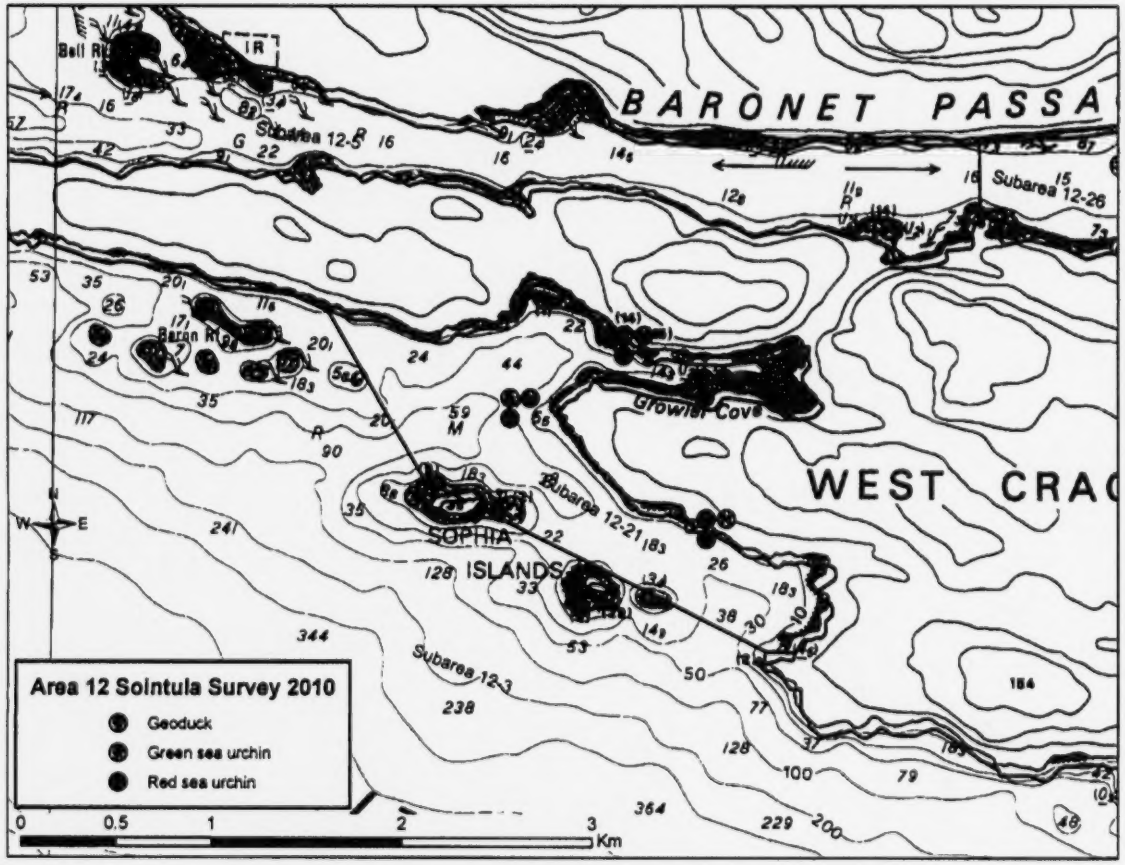

Figure 27c. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 12–21. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

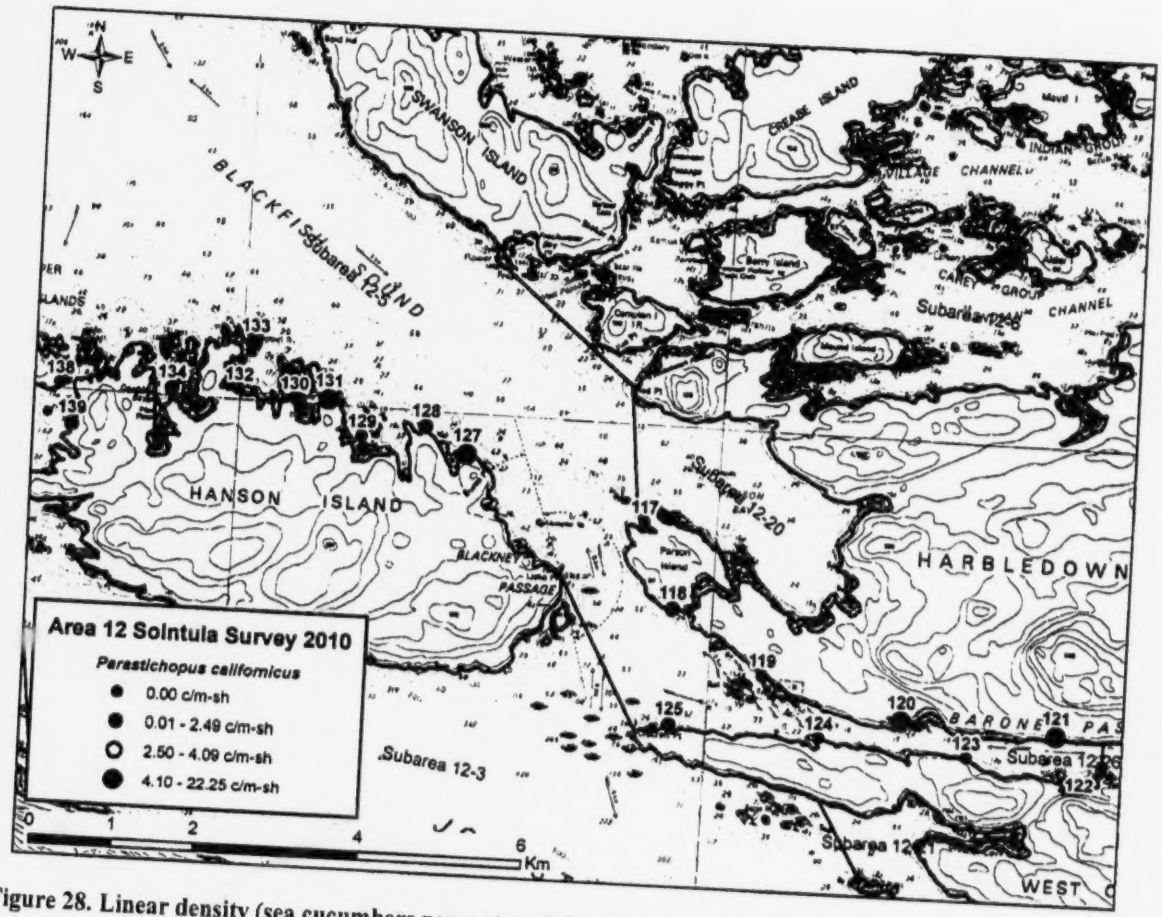

Figure 28. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 12–5, surveyed as part of the Area 12 Sointula survey in 2010. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (densities above East Coast Vancouver Island regional baseline density).

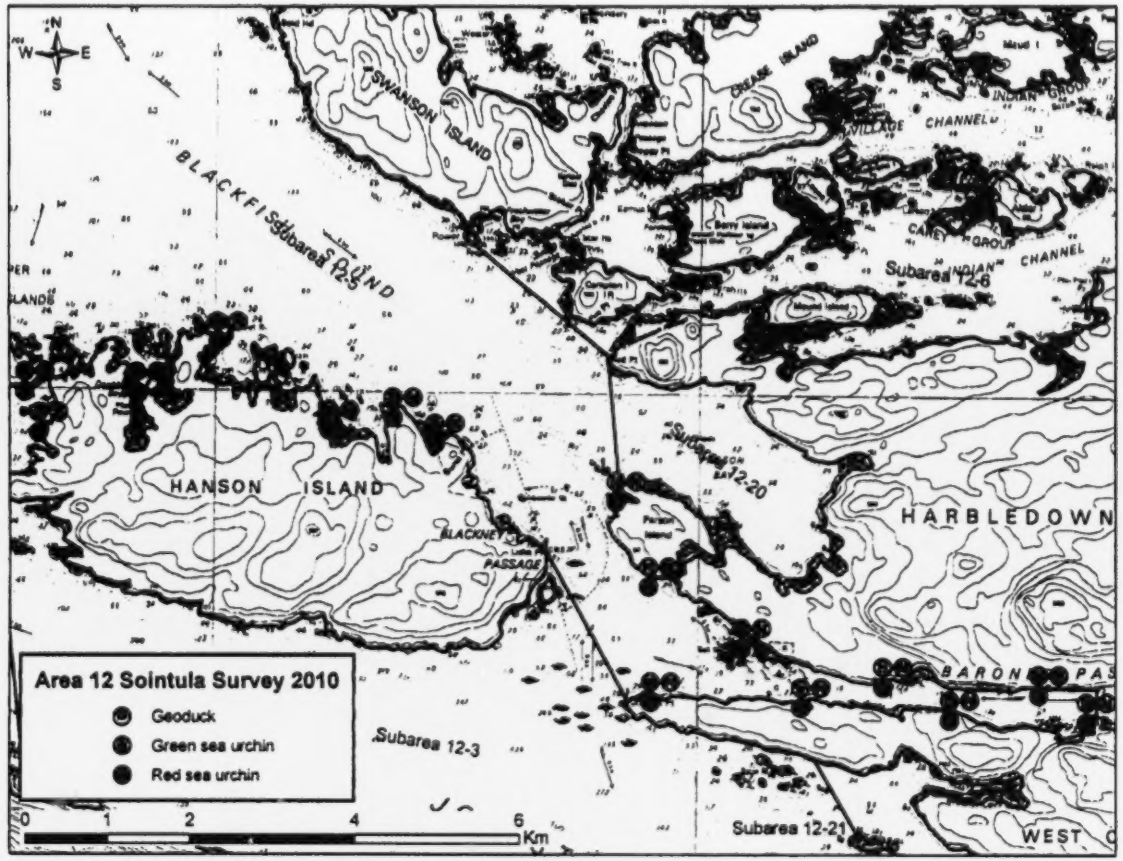

Figure 29. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 12–5. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

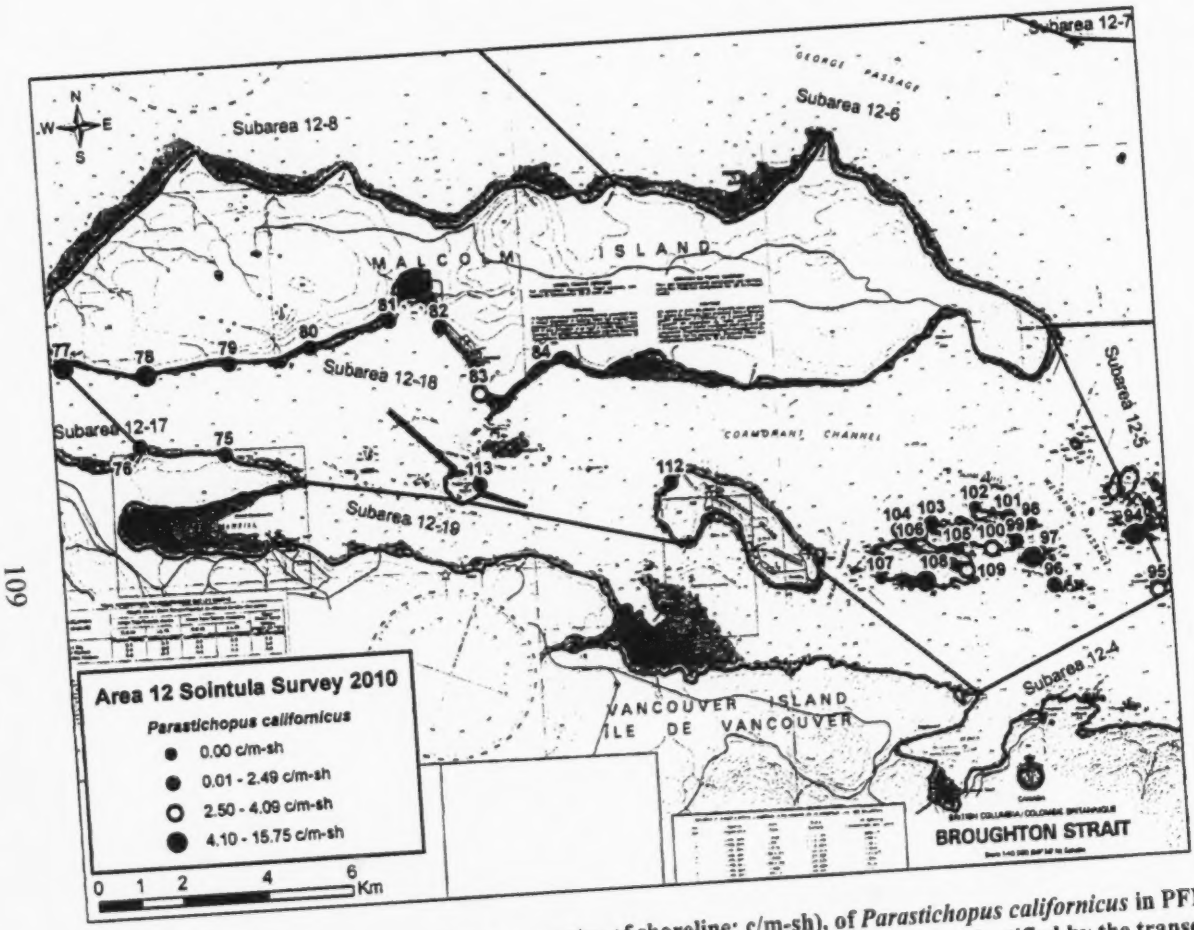

Figure 30. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 12–18, surveyed as part of the Area 12 Sointula survey in 2010. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (densities above East Coast Vancouver Island regional baseline density).

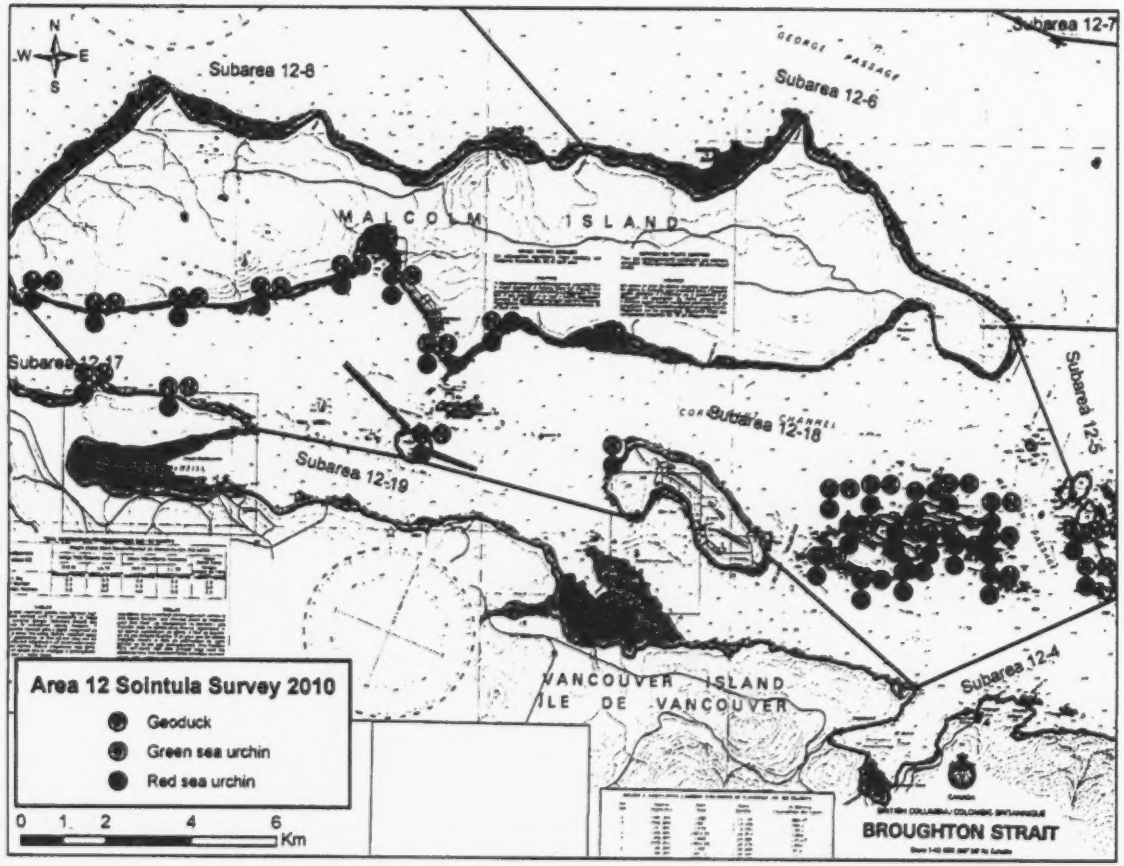

Figure 31. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 12–18. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

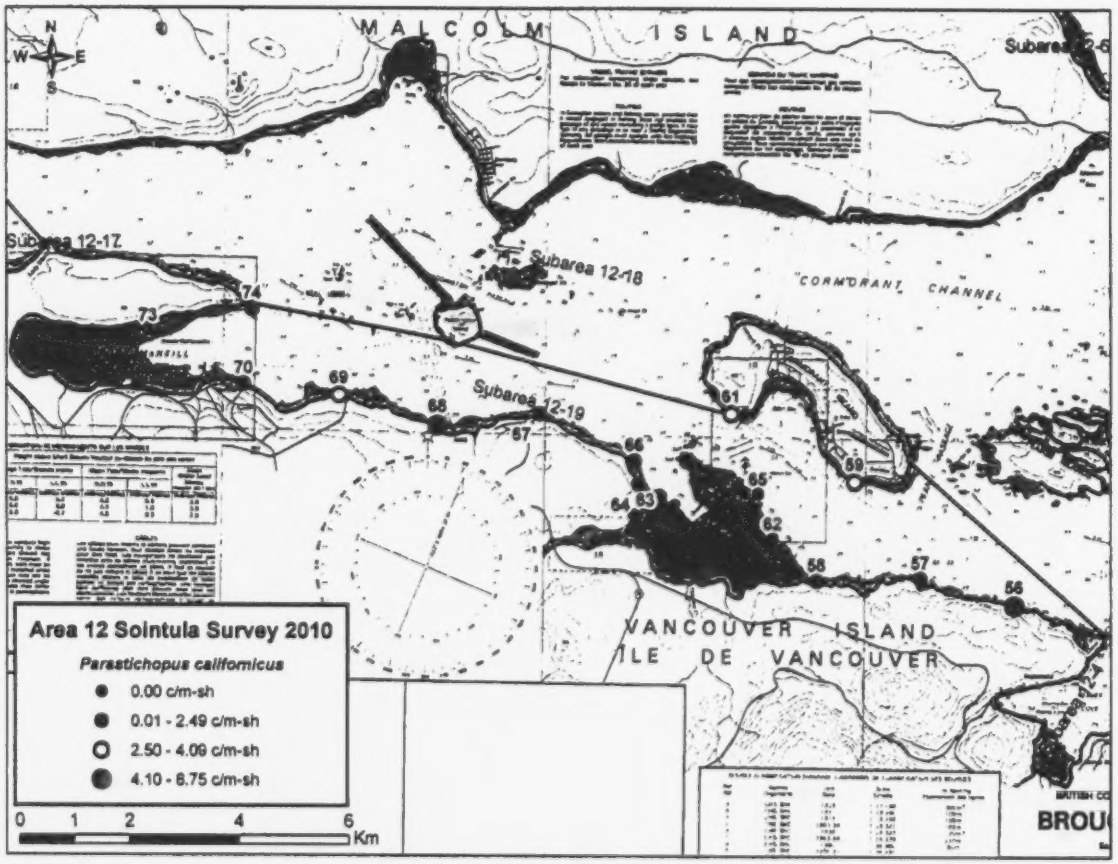

Figure 32. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 12–19 surveyed as part of the Area 12 Sointula survey in 2010. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (densities above East Coast Vancouver Island regional baseline density).

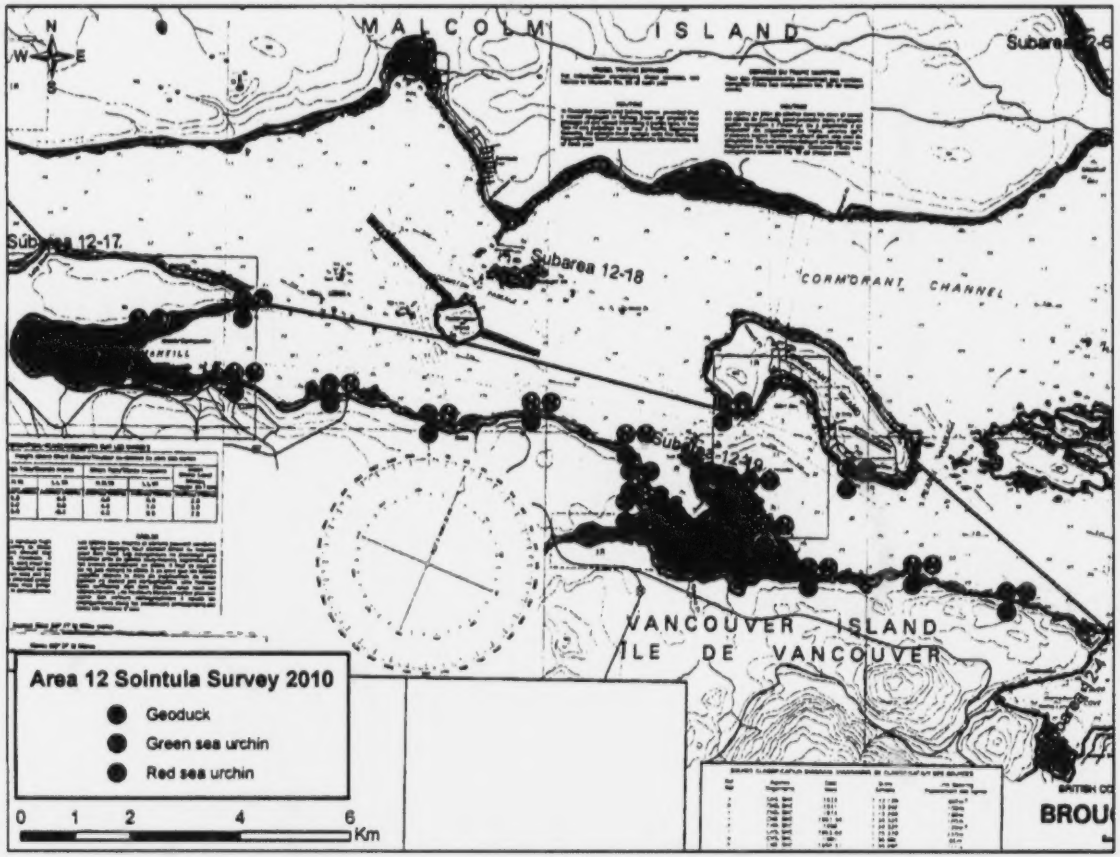

Figure 33. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 12–19. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

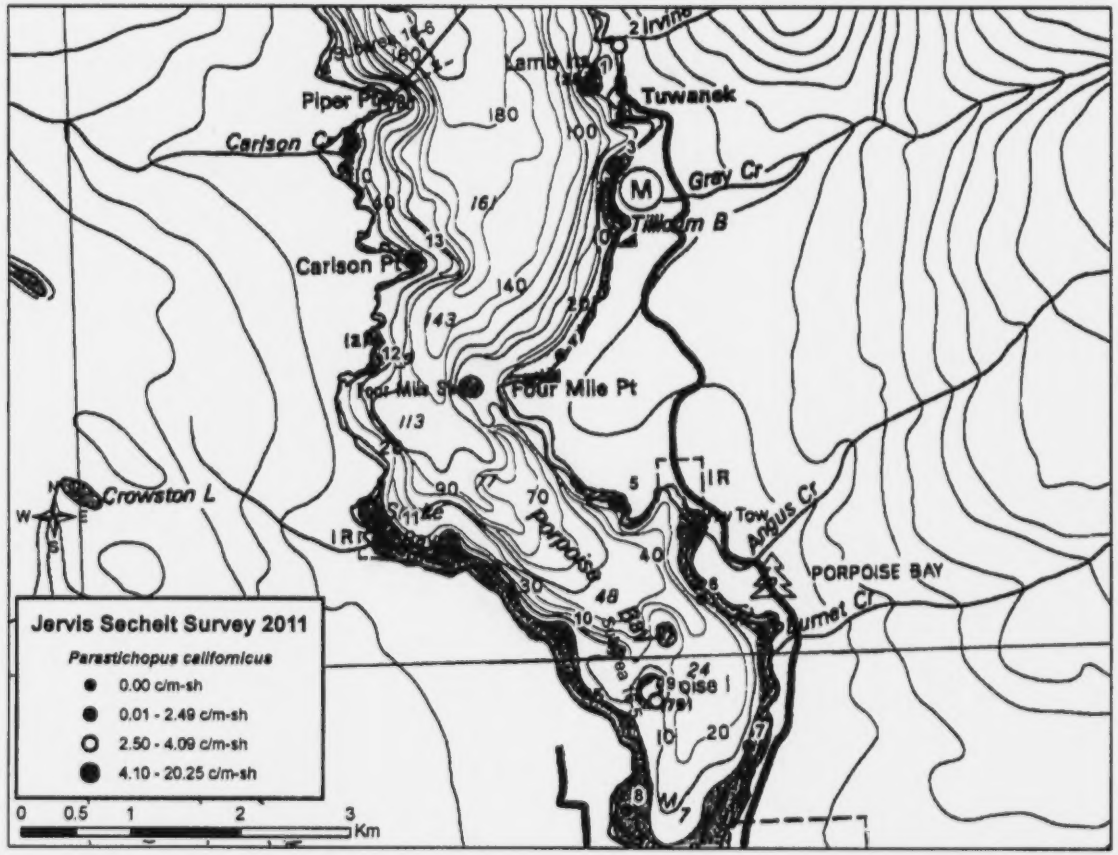

Figure 34. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 16–5, surveyed as part of the Jervis Inlet Sechelt survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (densities above East Coast Vancouver Island regional baseline density).

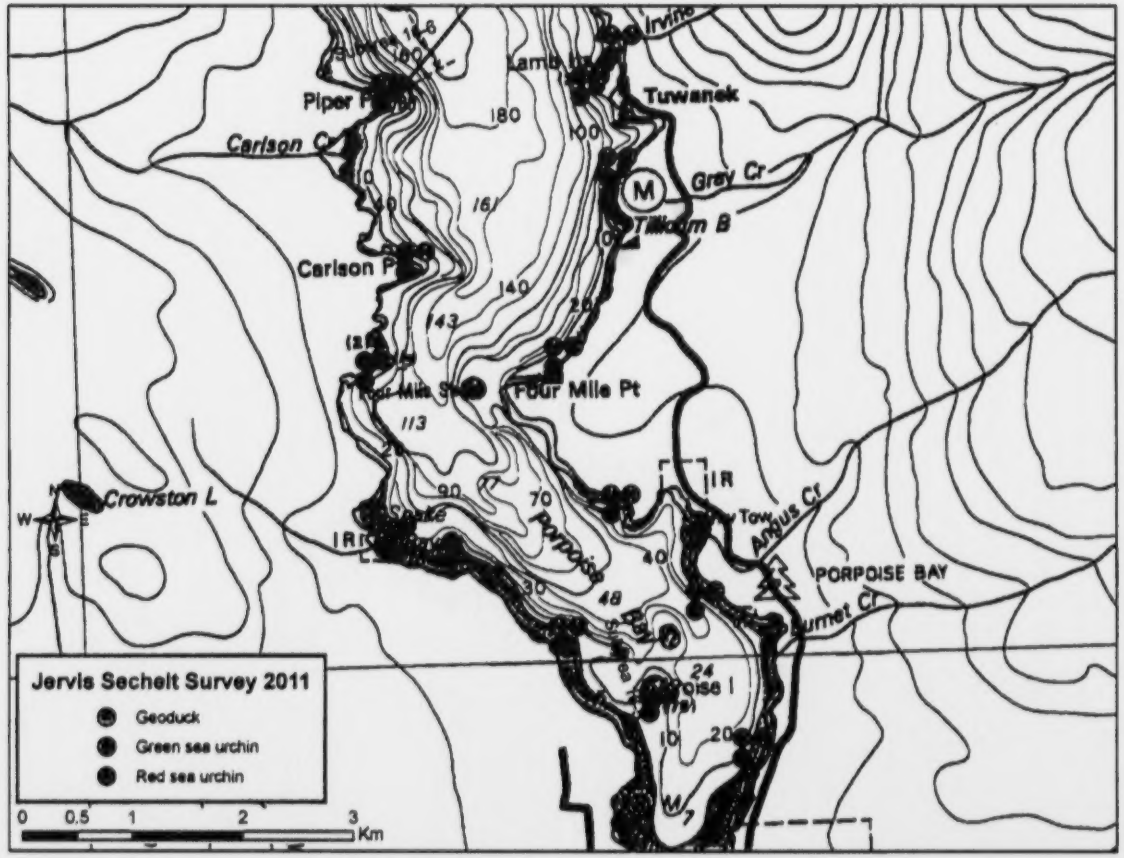

Figure 35. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 16–5. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

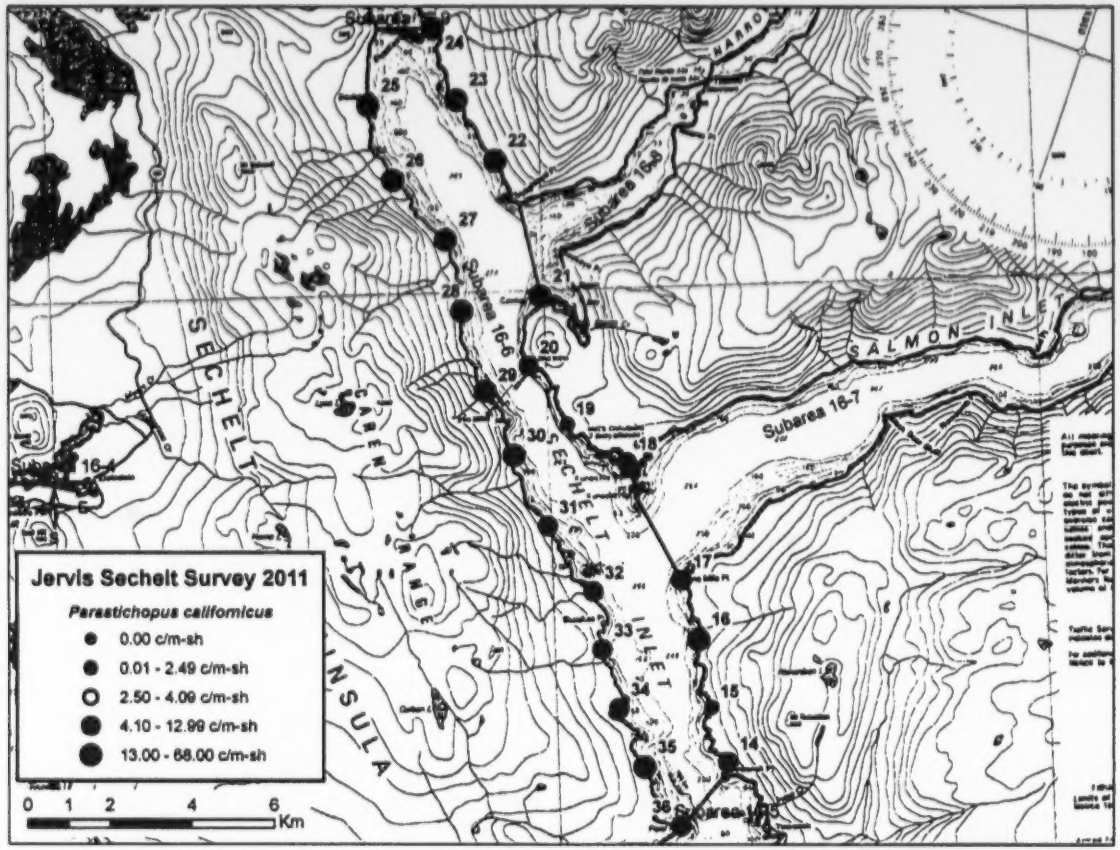

Figure 36. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 16–6, surveyed as part of the Jervis Inlet Sechelt survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (densities between the East Coast Vancouver Island regional baseline density and 12.99 c/m-sh); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

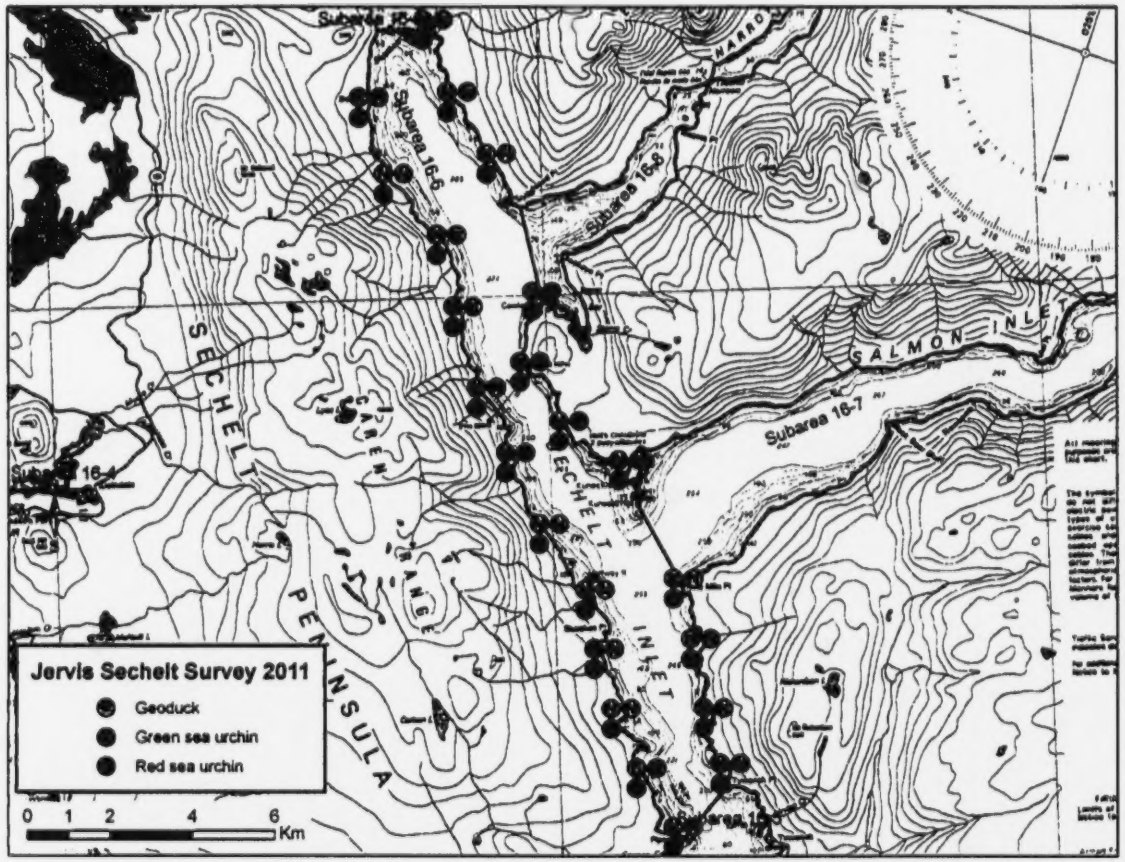

Figure 37. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 16–6. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

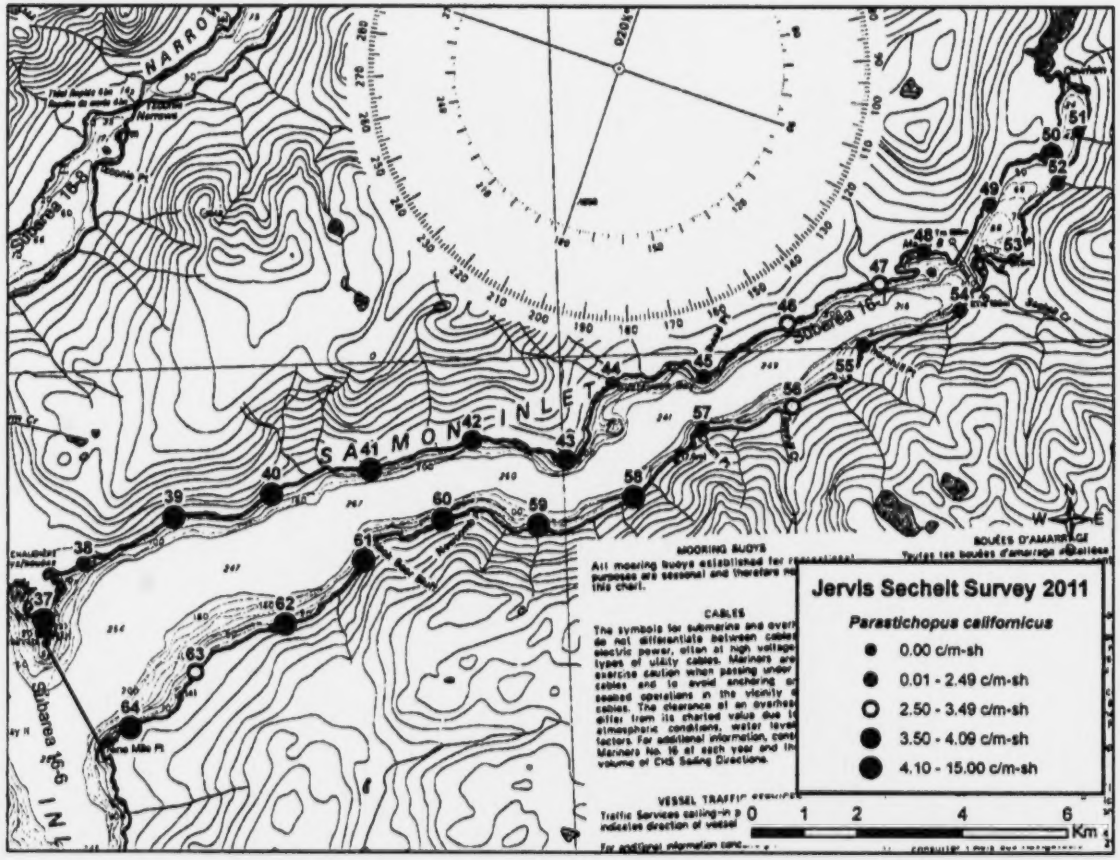

Figure 38. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 16–7, surveyed as part of the Jervis Inlet Sechelt survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 3.49 c/m-sh); green = productive locations (between the bootstrapped lower 90% confidence bound calculated for the Subarea and 4.09 c/m-sh); blue = very productive locations (densities above East Coast Vancouver Island regional baseline density).

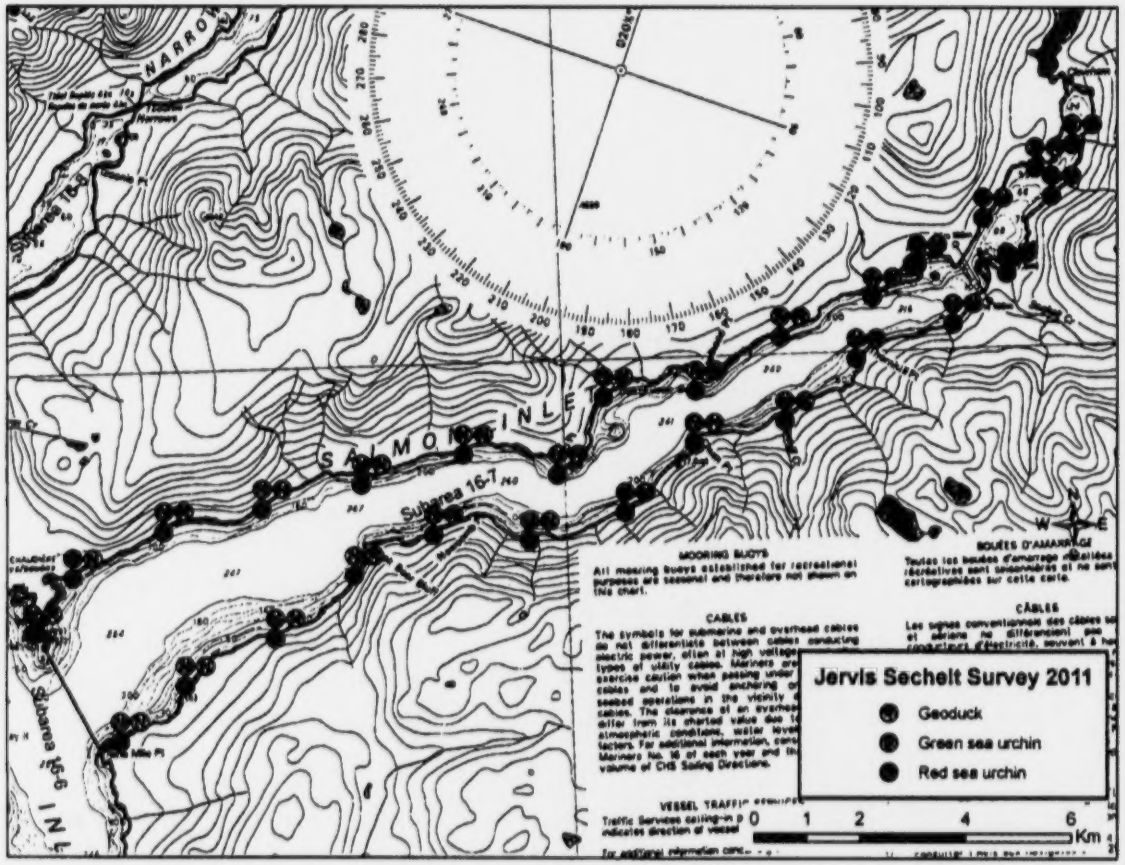

Figure 39. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 16–7. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

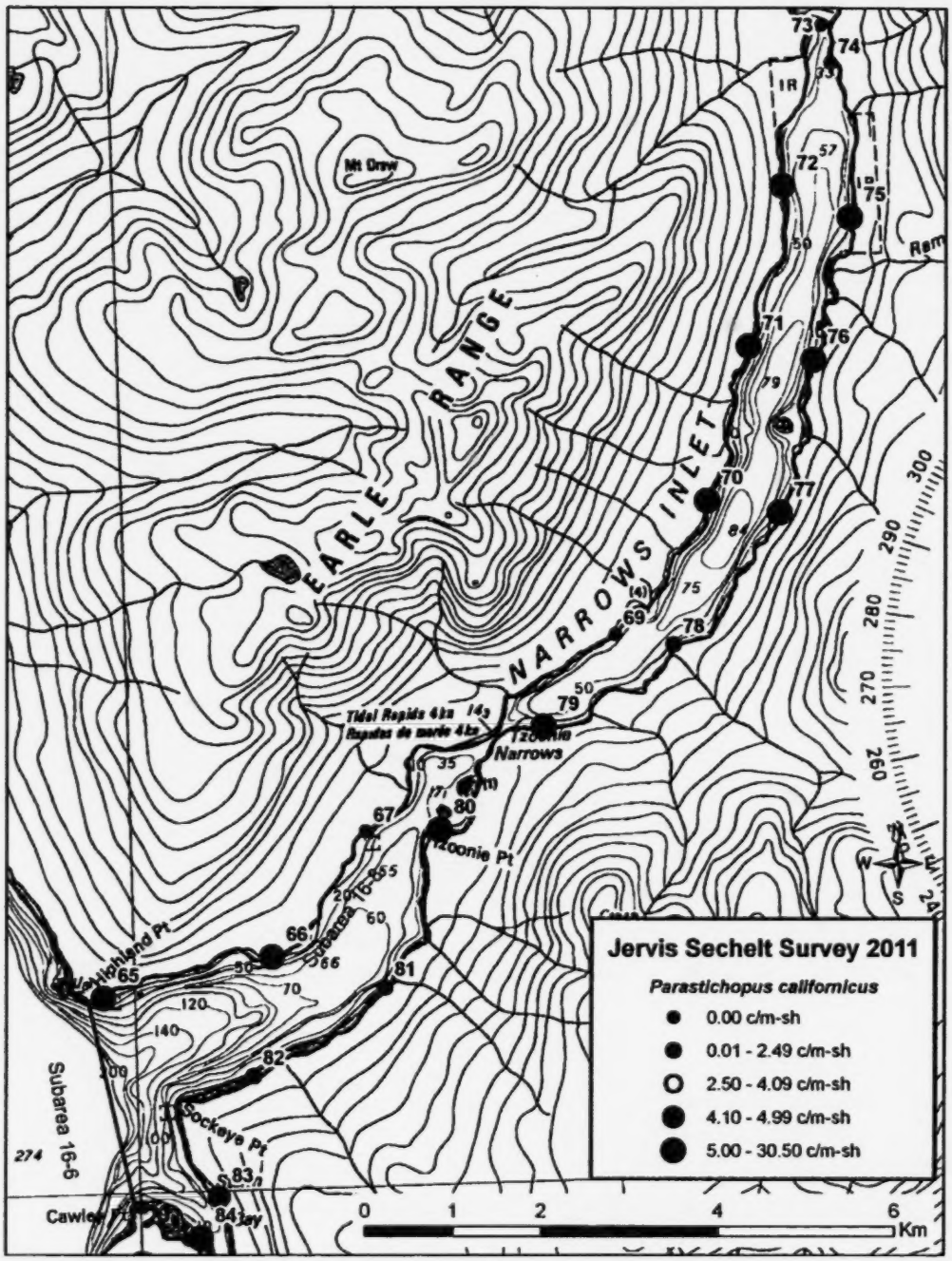

Figure 40. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 16–8, surveyed as part of the Jervis Inlet Sechelt survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (densities between the East Coast Vancouver Island regional baseline density and 4.99 c/m-sh); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

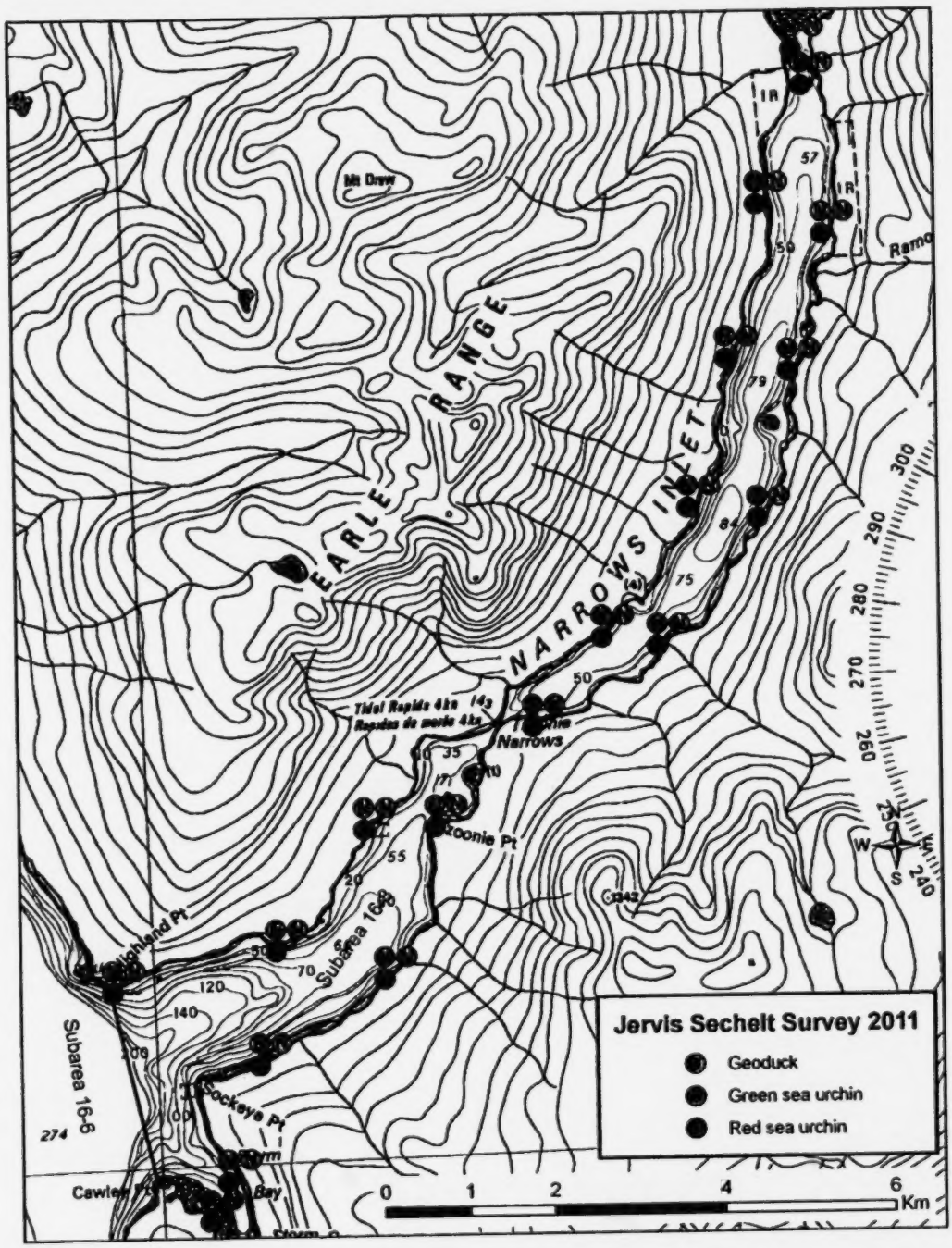

Figure 41. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 16–8. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

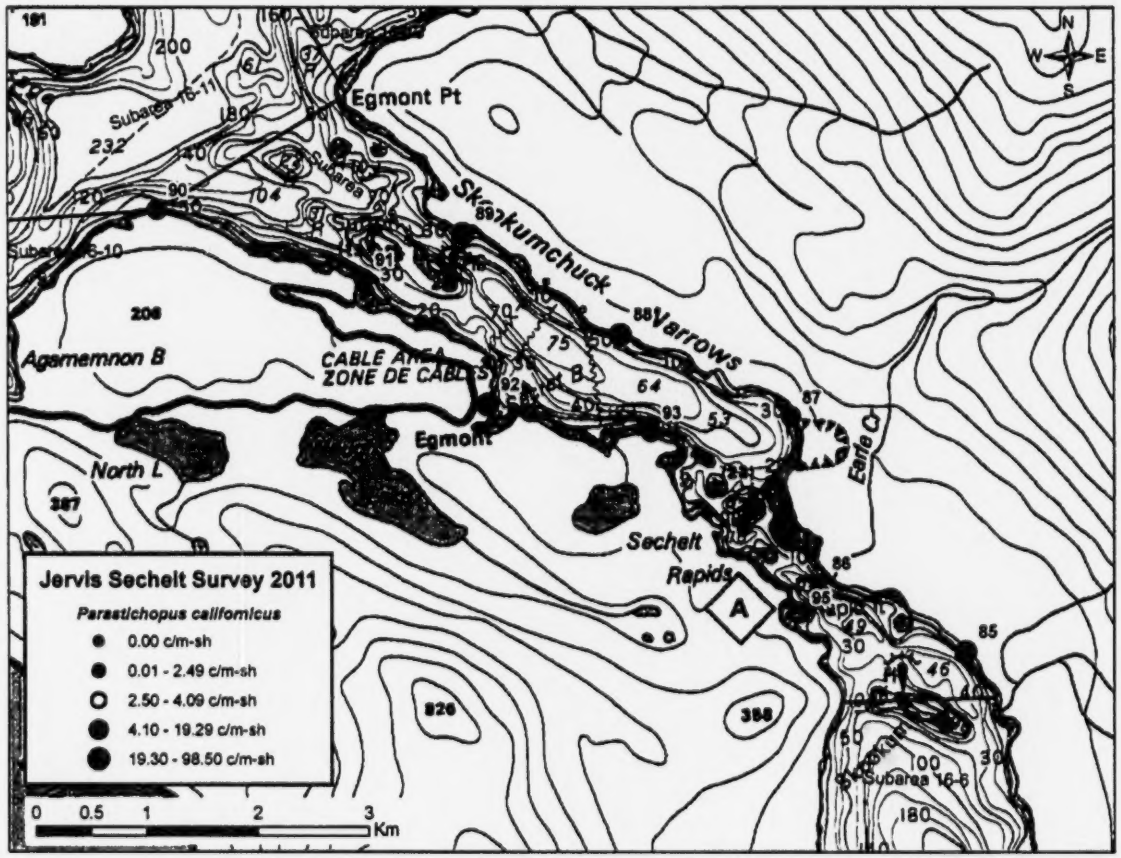

Figure 42. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 16–9, surveyed as part of the Jervis Inlet Sechelt survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (densities between the East Coast Vancouver Island regional baseline density and 19.29 c/m-sh); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

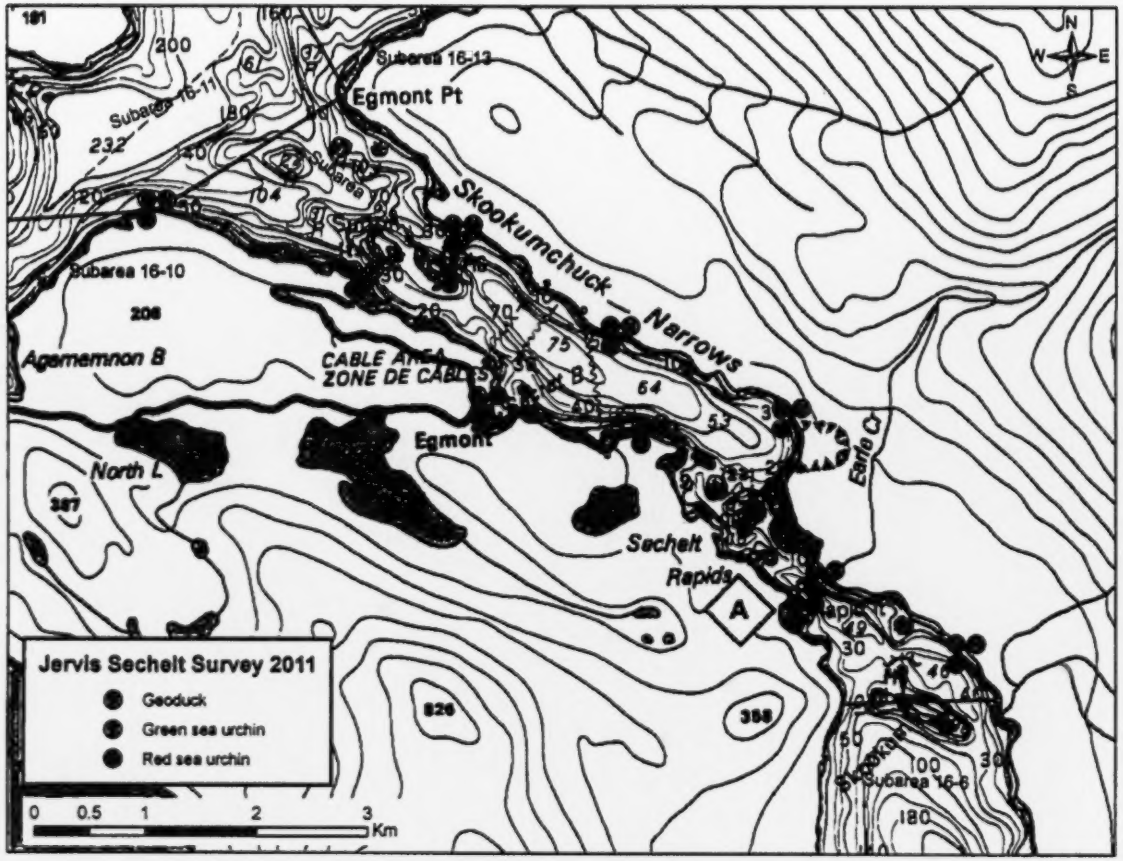

Figure 43. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 16–9. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

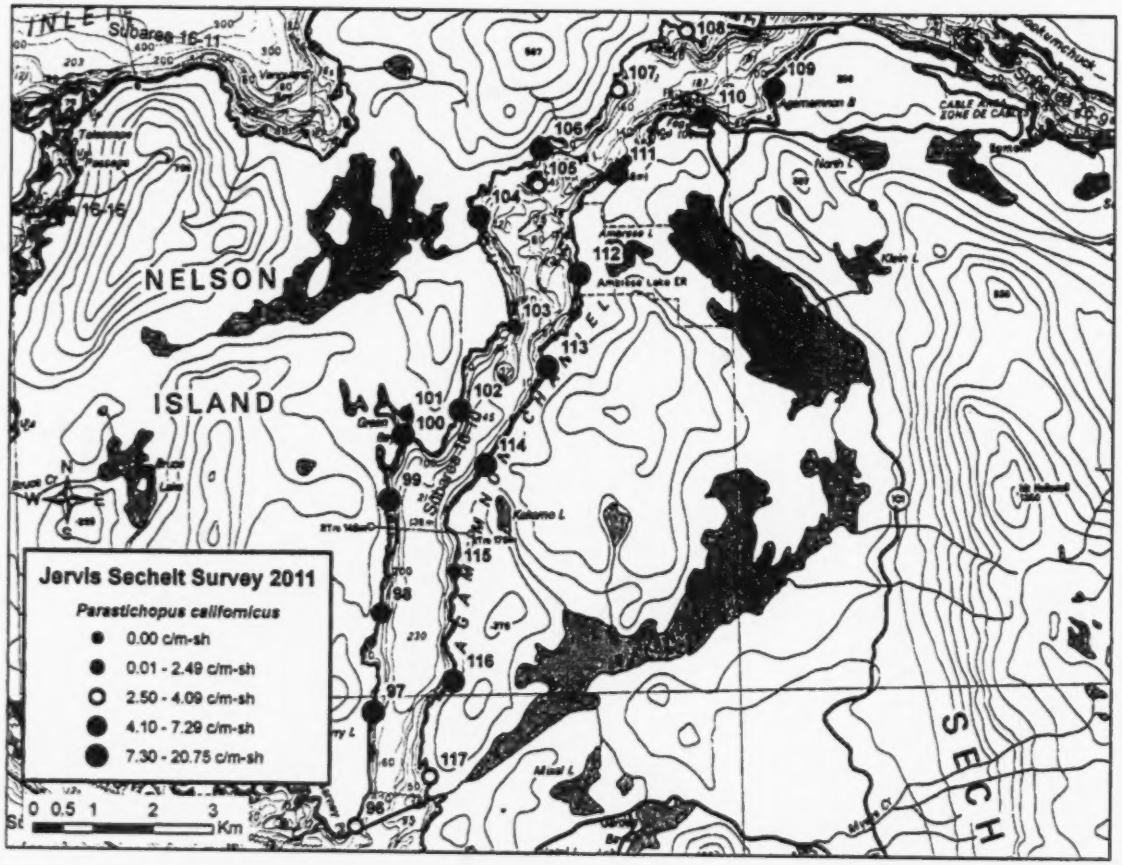

Figure 44. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 16–10, surveyed as part of the Jervis Inlet Sechelt survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (densities between the East Coast Vancouver Island regional baseline density and 7.29 c/m-sh); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

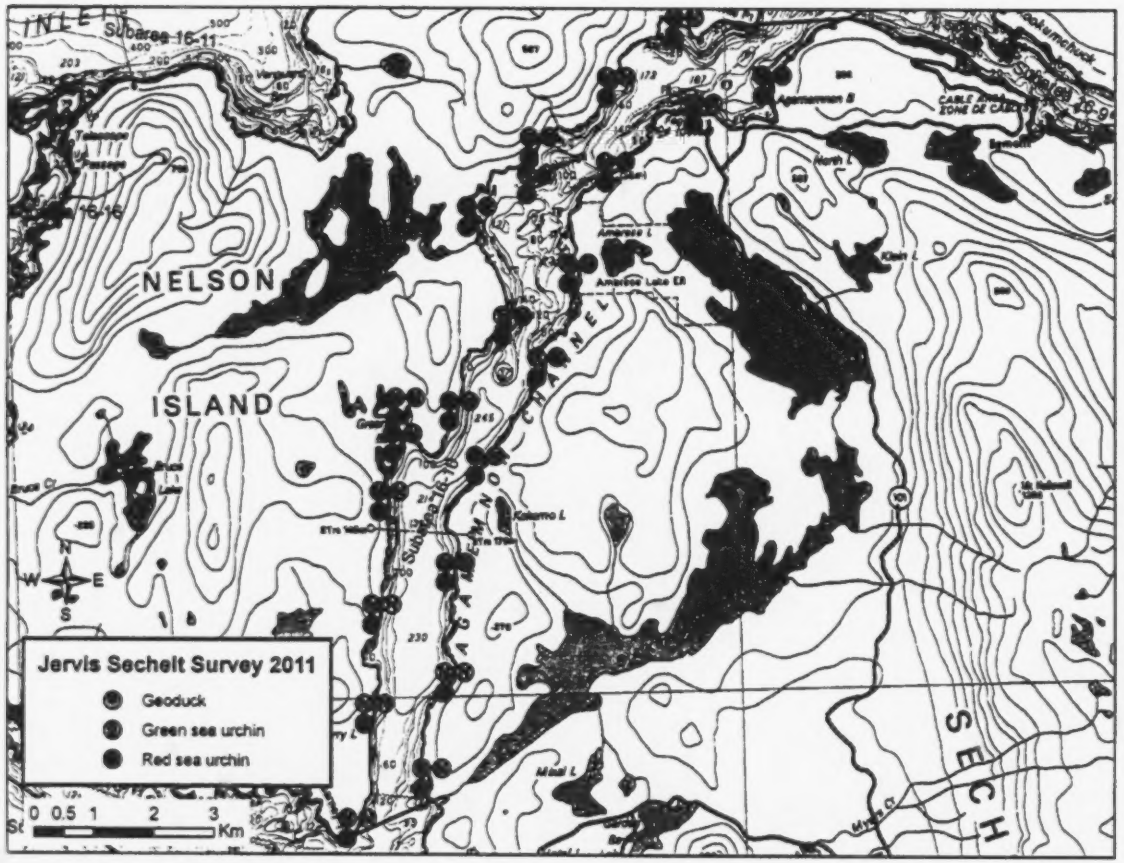

Figure 45. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 16–10. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

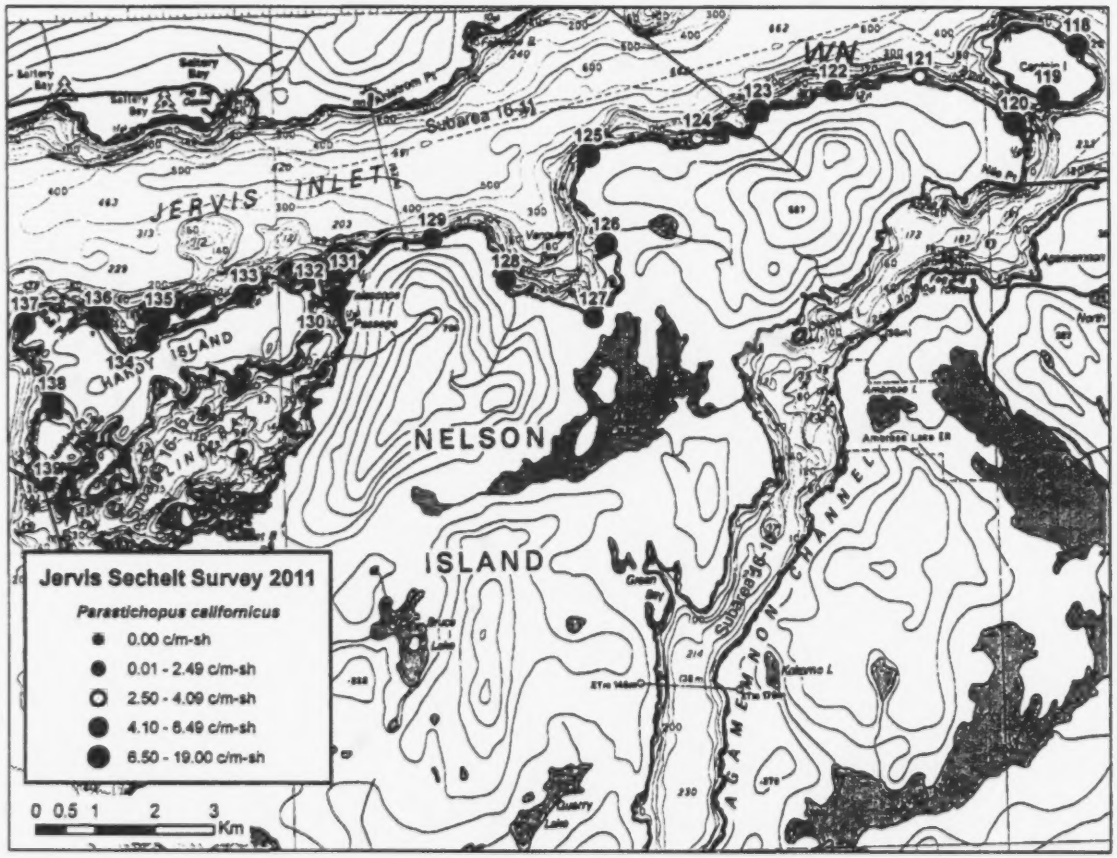

Figure 46. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 16–11, surveyed as part of the Jervis Inlet Sechelt survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (densities between the East Coast Vancouver Island regional baseline density and 6.49 c/m-sh); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

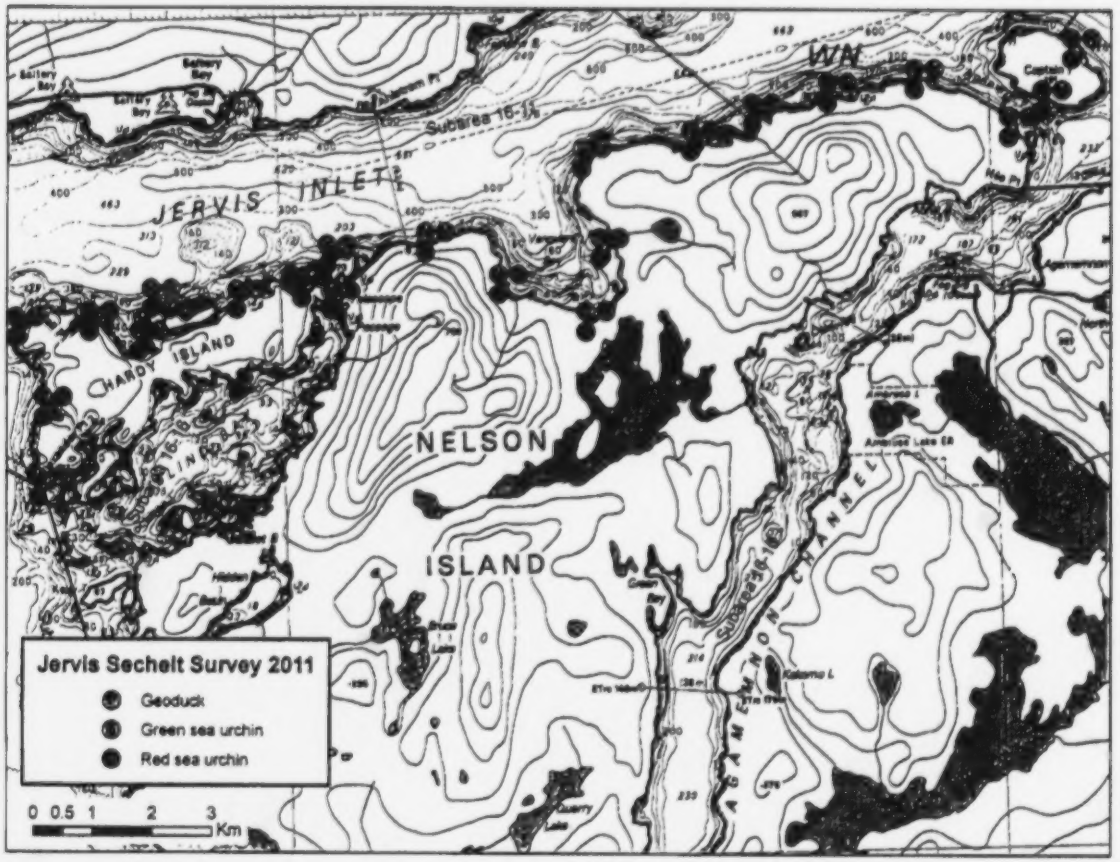

Figure 47. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 16–11. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

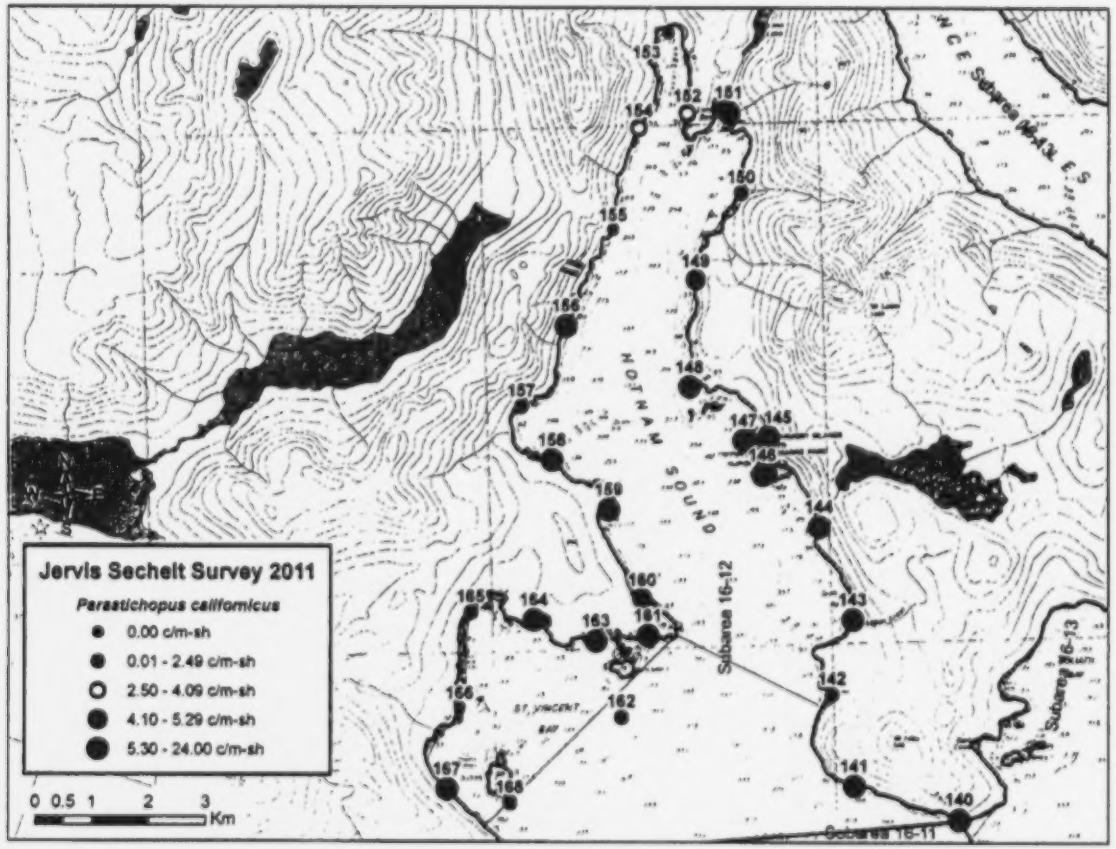

Figure 48. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 16–12, surveyed as part of the Jervis Inlet Sechelt survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (densities between the East Coast Vancouver Island regional baseline density and 5.29 c/m-sh); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

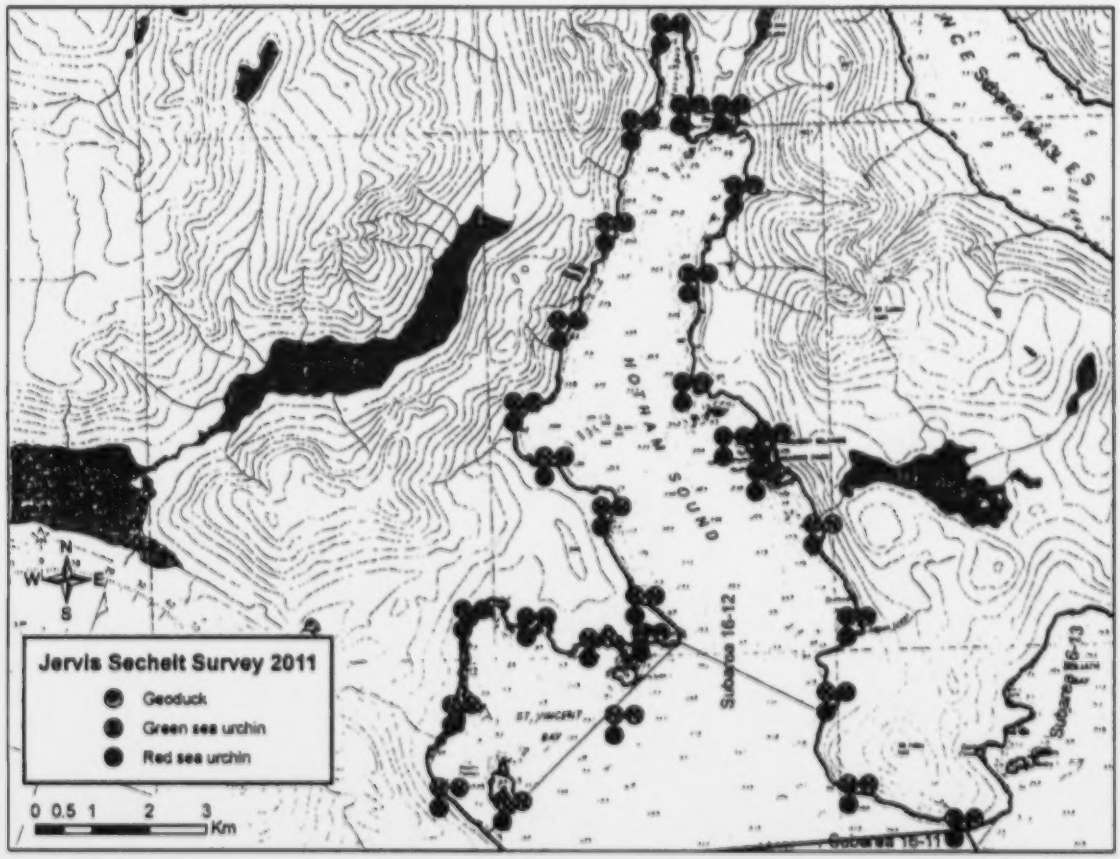

Figure 49. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 16–12. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

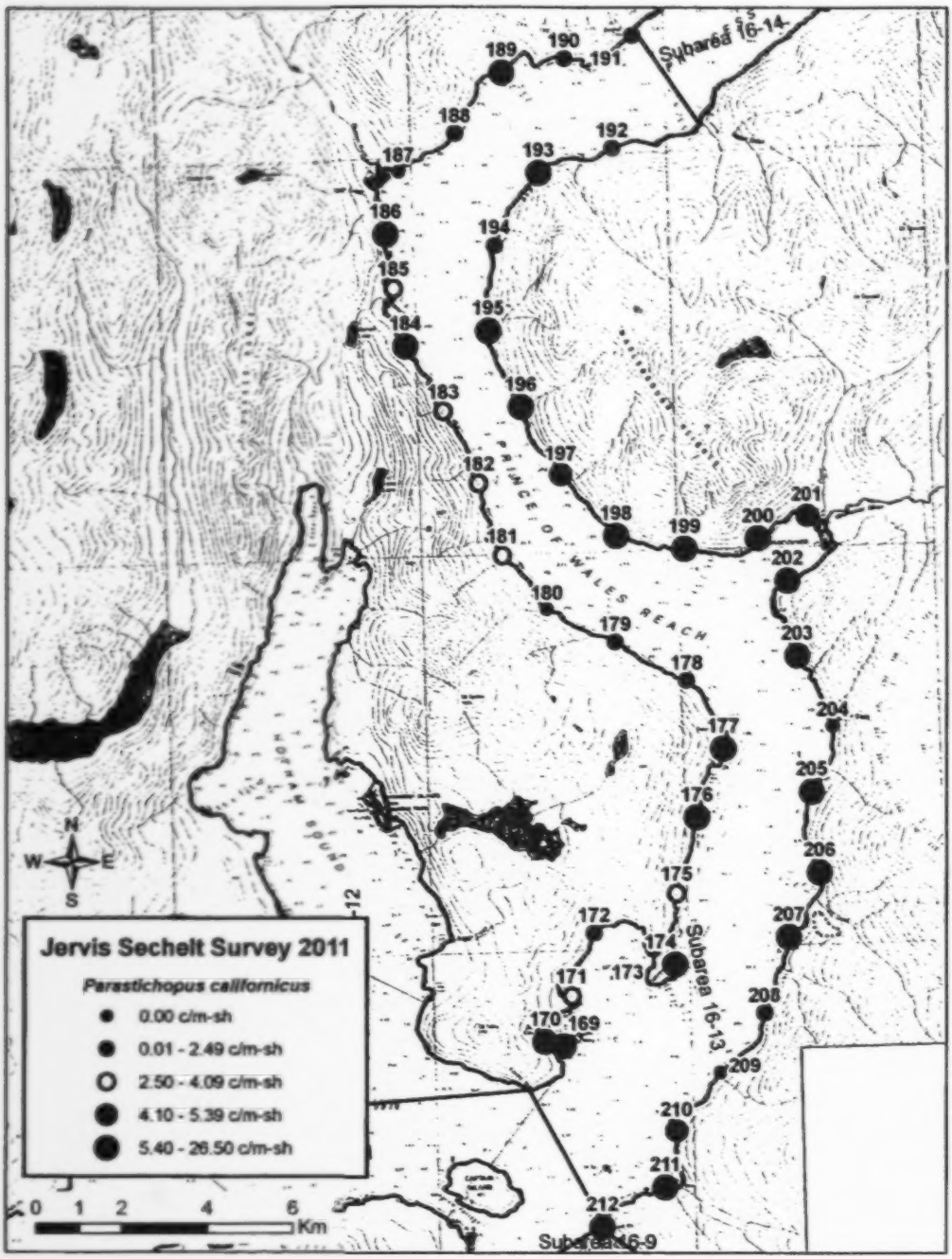

Figure 50. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 16–13, surveyed as part of the Jervis Inlet Sechelt survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (densities between the East Coast Vancouver Island regional baseline density and 5.39 c/m-sh); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

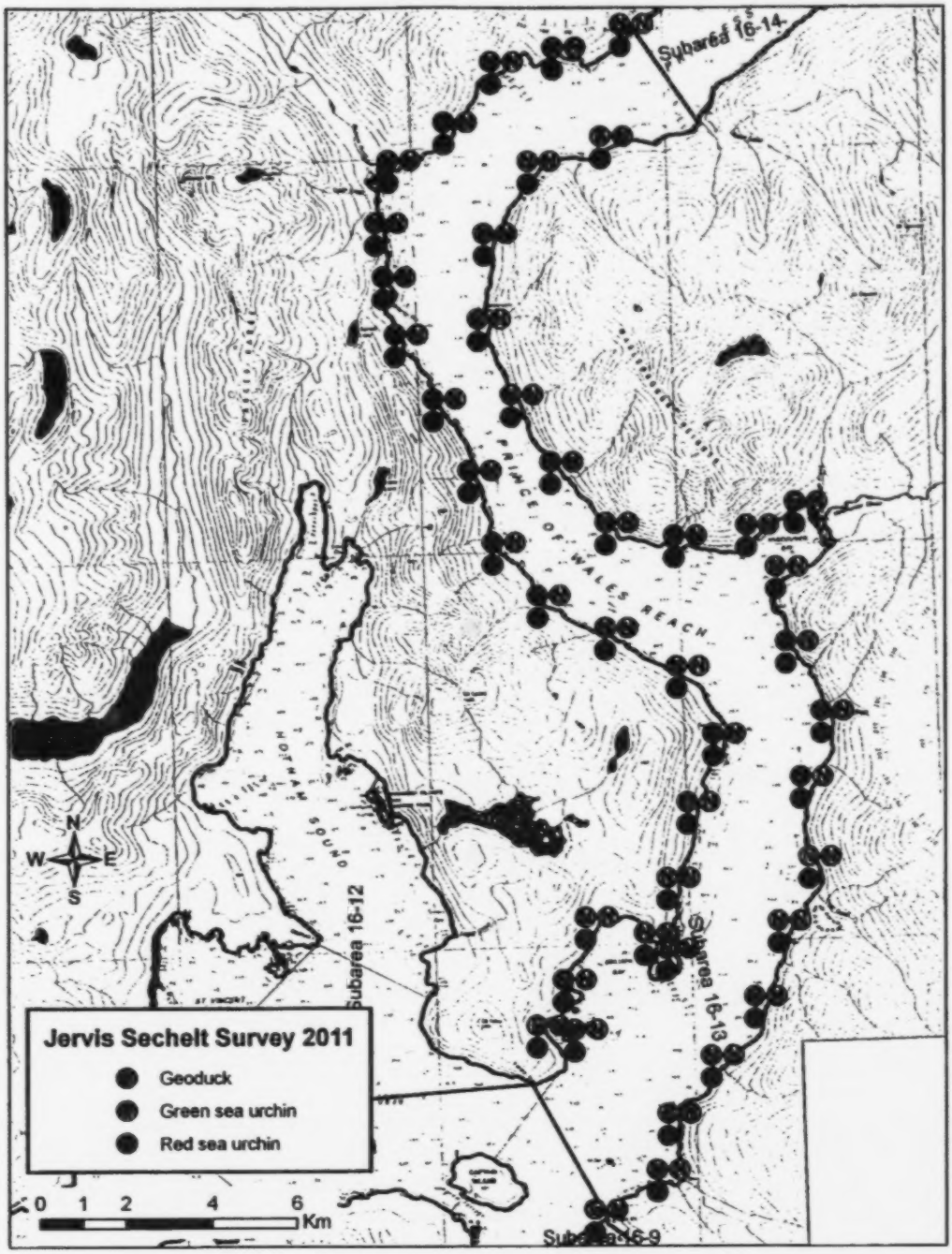

Figure 51. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 16–13. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

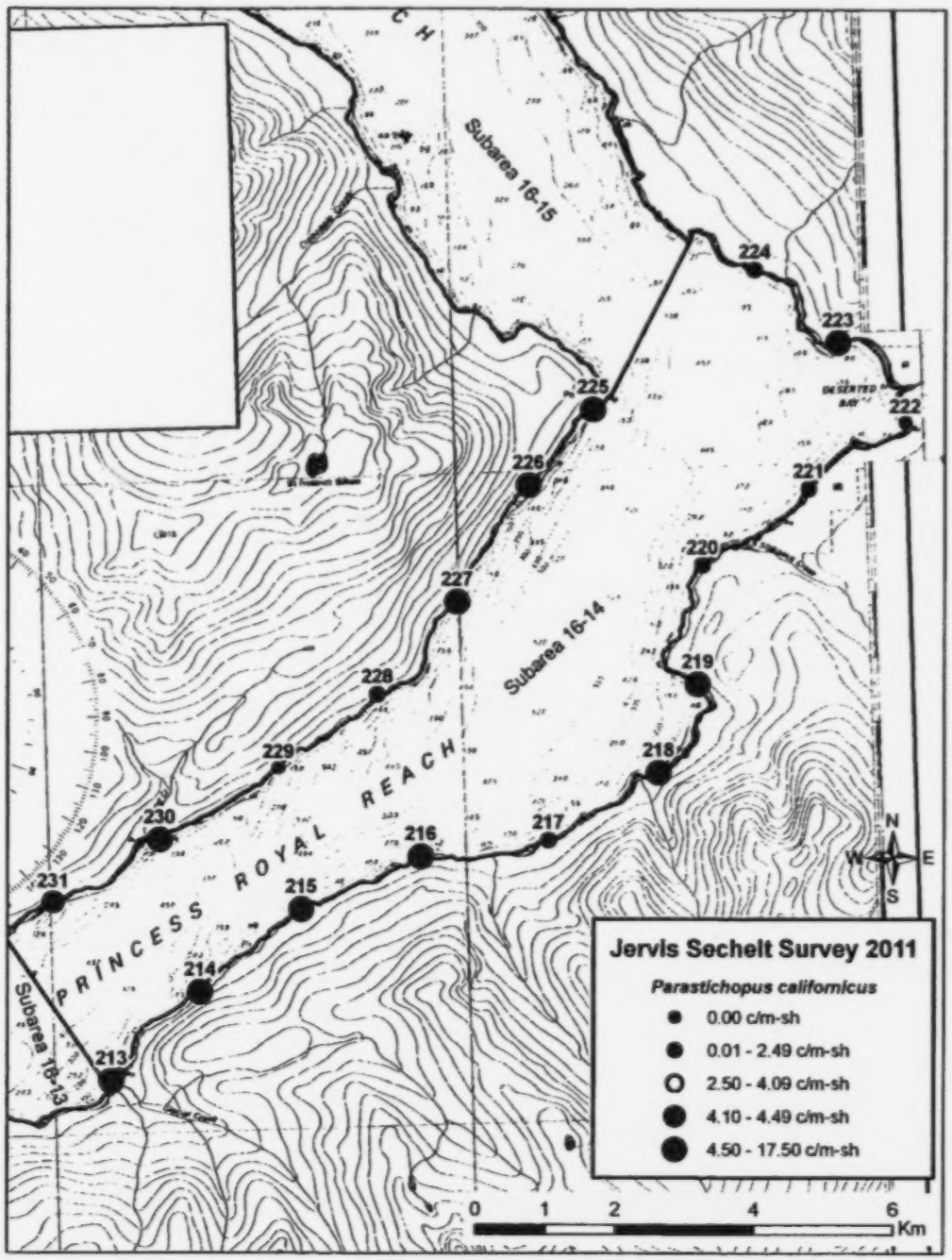

Figure 52. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 16–14, surveyed as part of the Jervis Inlet Sechelt survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (densities between the East Coast Vancouver Island regional baseline density and 4.49 c/m-sh); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

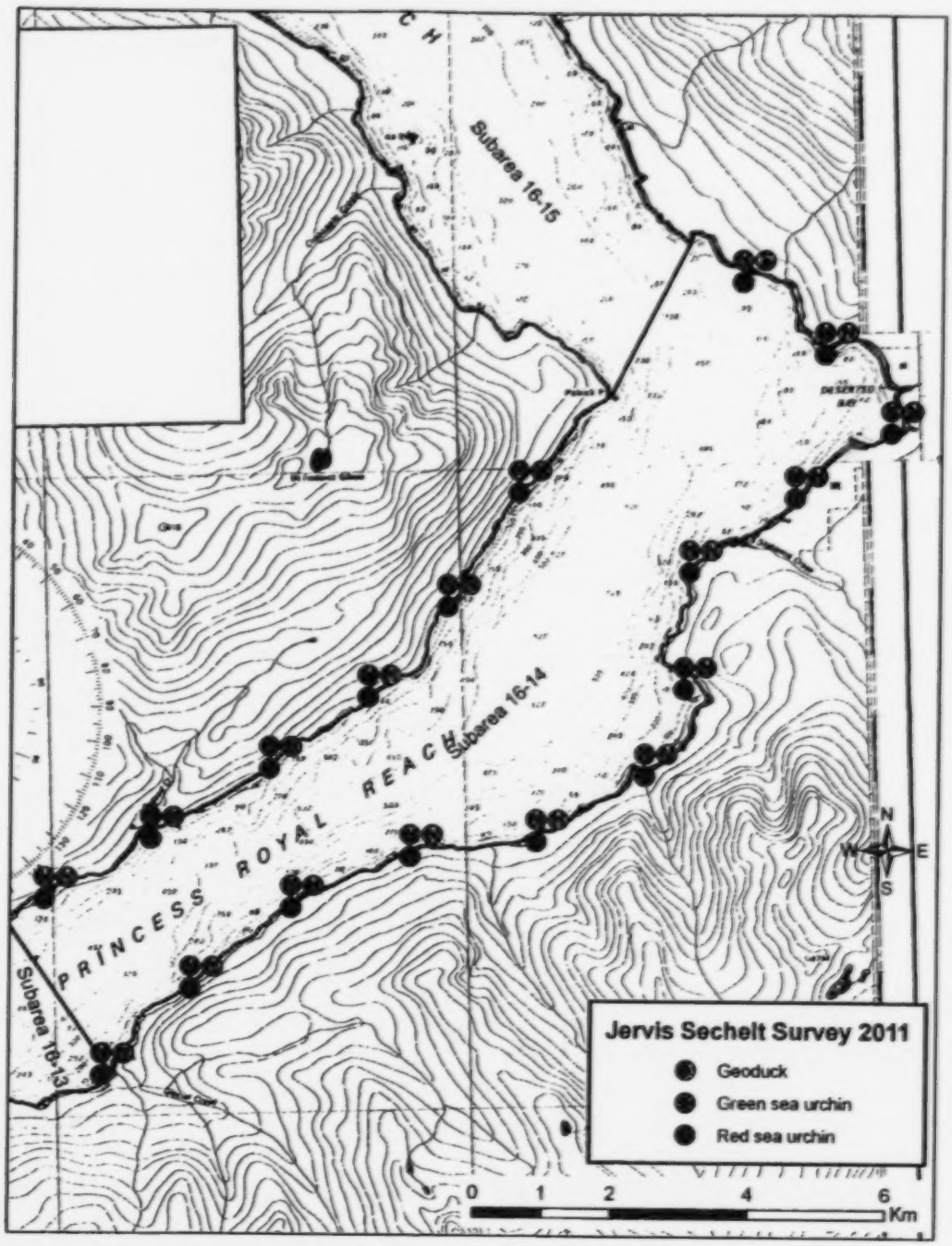

Figure 53. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 16–14. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

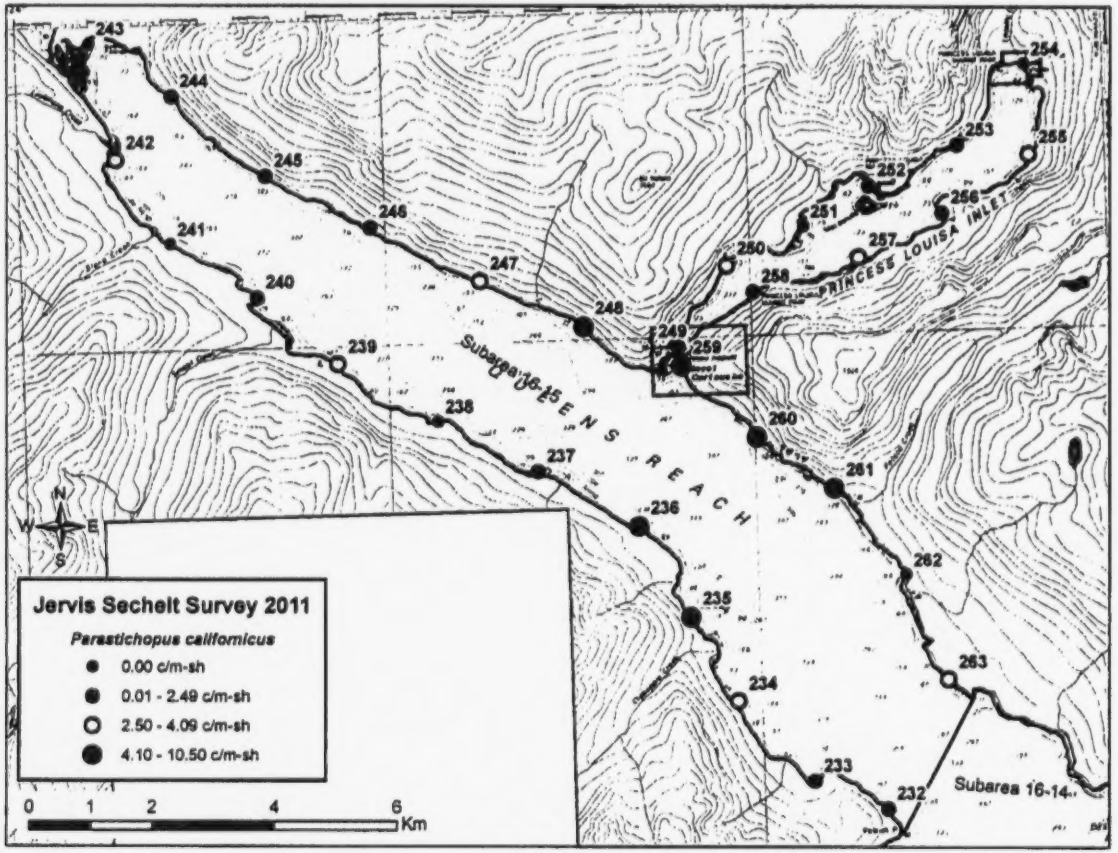

Figure 54. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 16–15, surveyed as part of the Jervis Inlet Sechelt survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (densities above East Coast Vancouver Island regional baseline density).

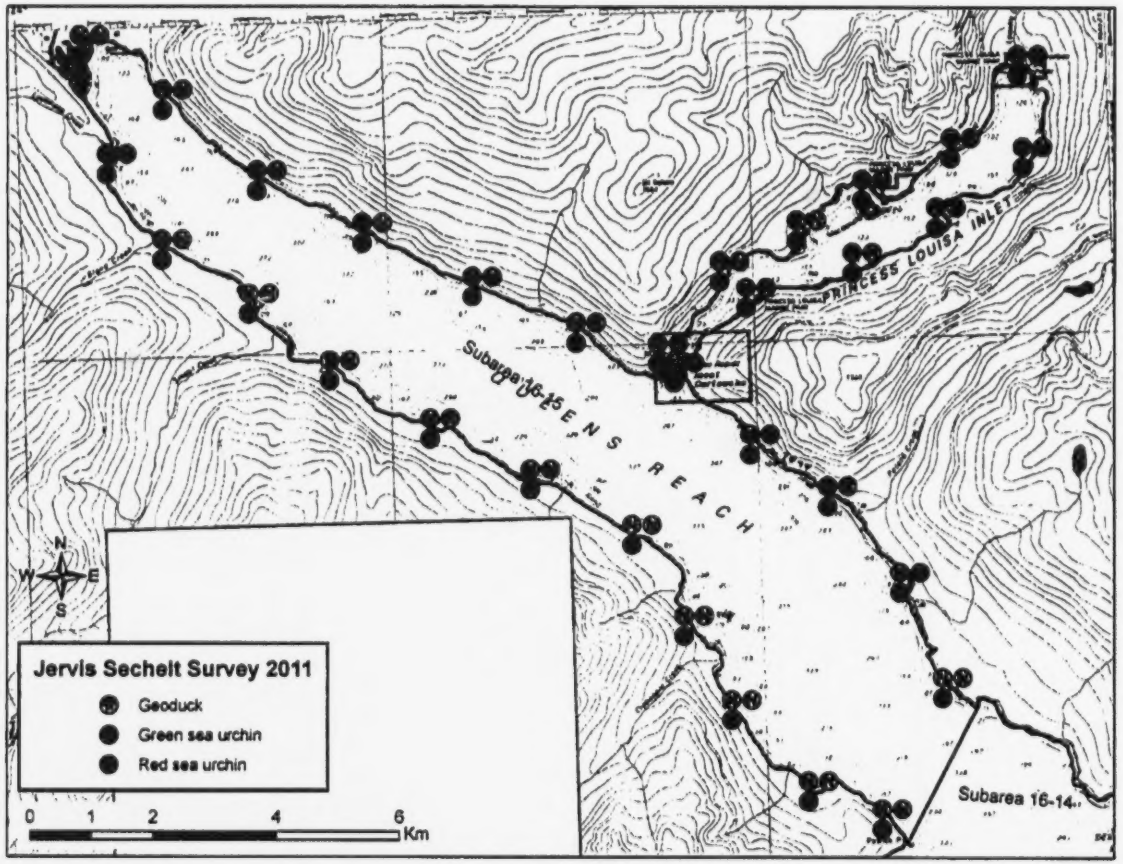

Figure 55. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 16–15. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

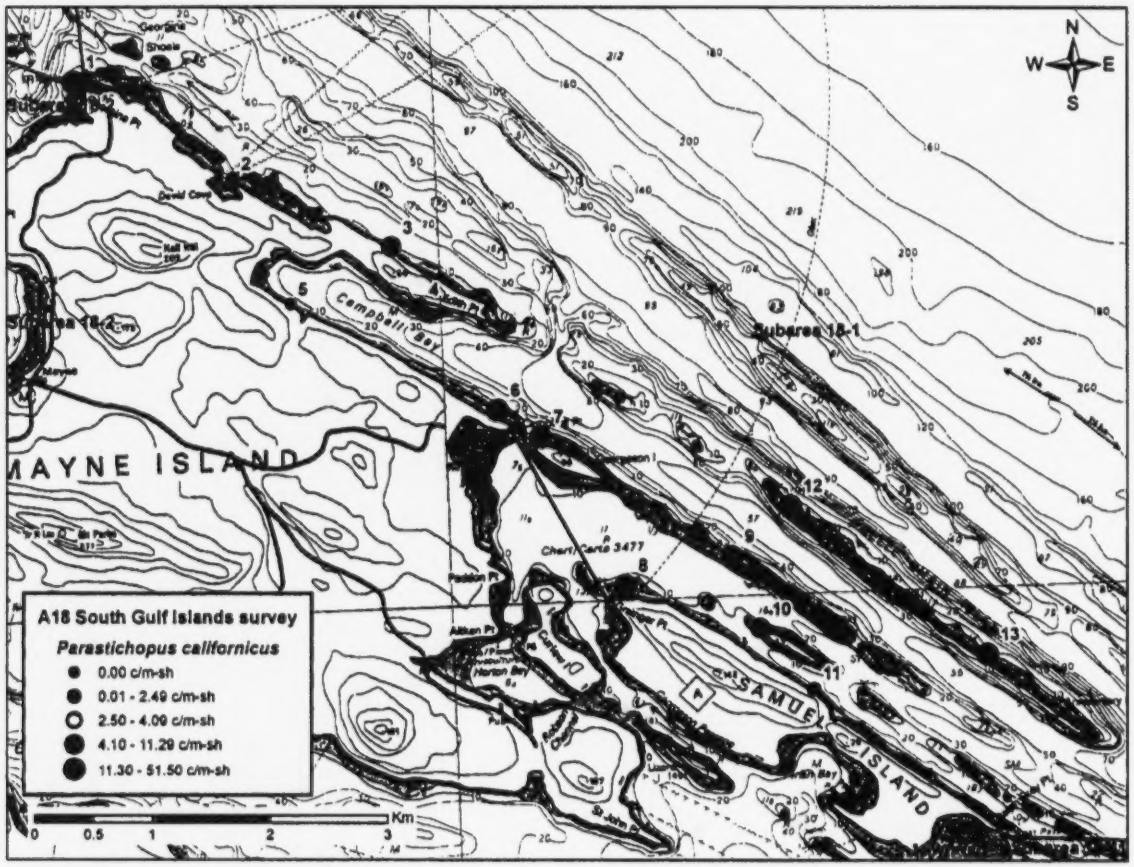

Figure 56. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 18–1, surveyed as part of the A18 South Gulf Islands survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (between 4.10 c/m-sh and the maximum observed density in the Subarea); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

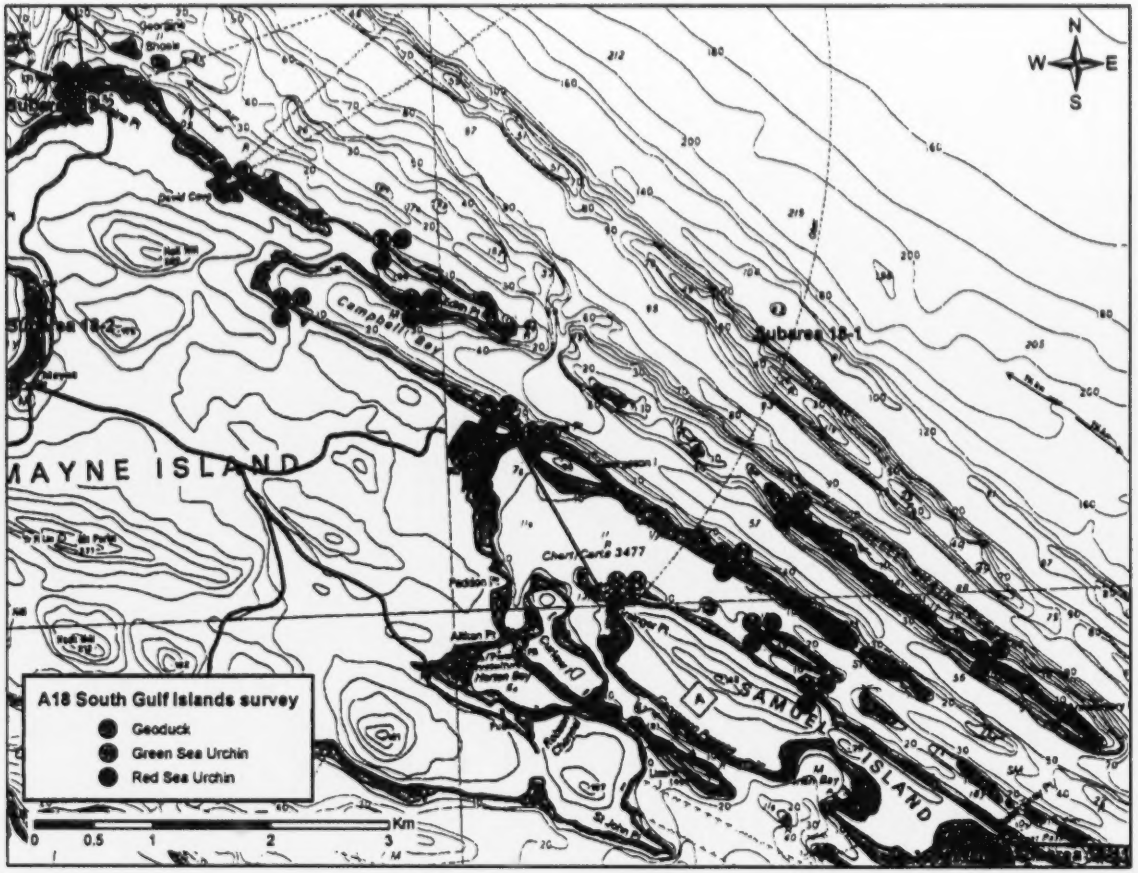

Figure 57. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 18–1. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

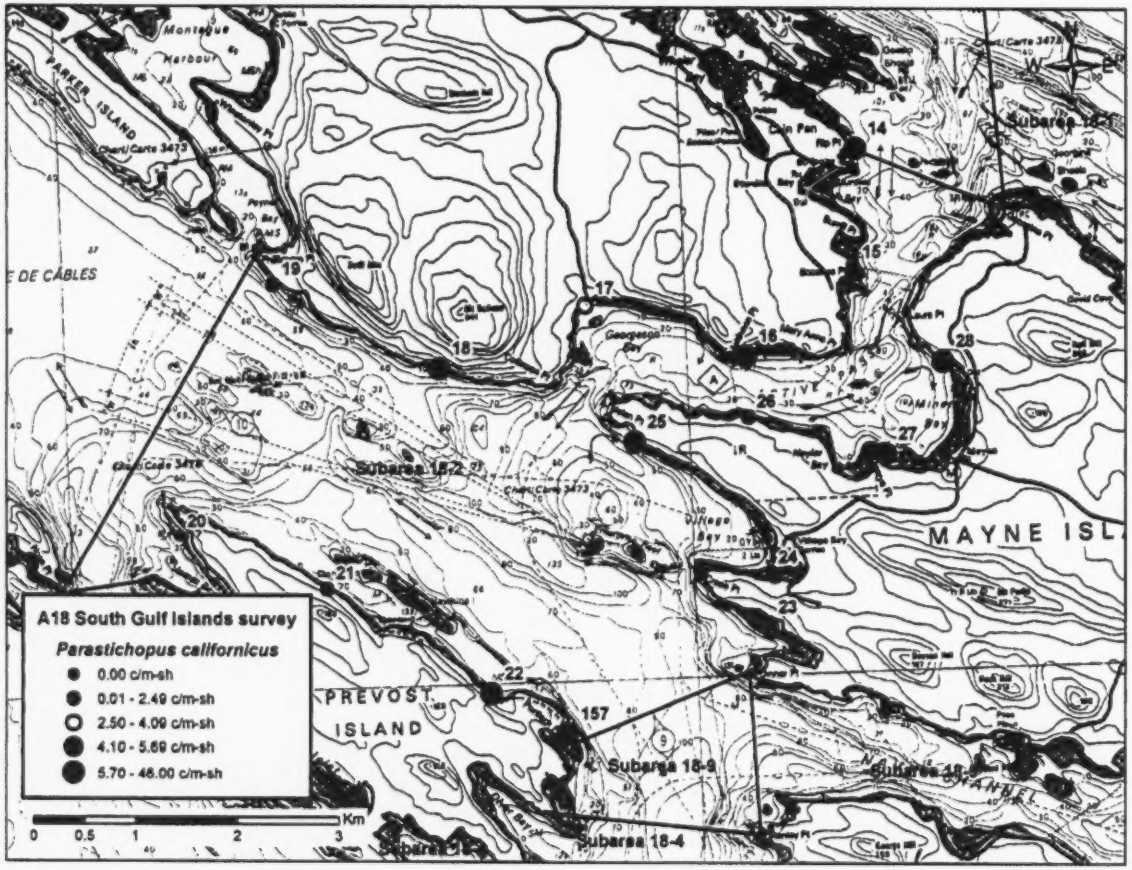

Figure 58. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 18–2 & 9, surveyed as part of the A18 South Gulf Islands survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (between 4.10 c/m-sh and the maximum observed density in the Subarea); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

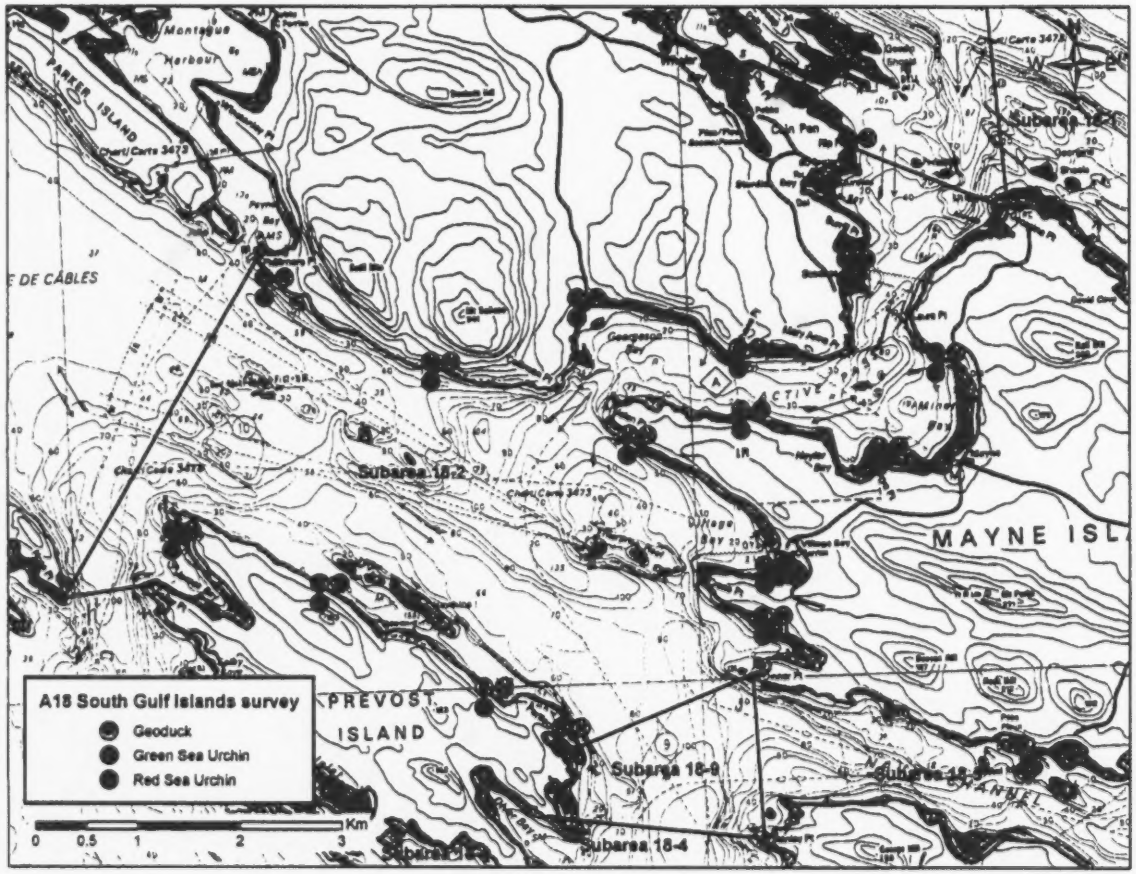

Figure 59. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 18–2 & 9. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

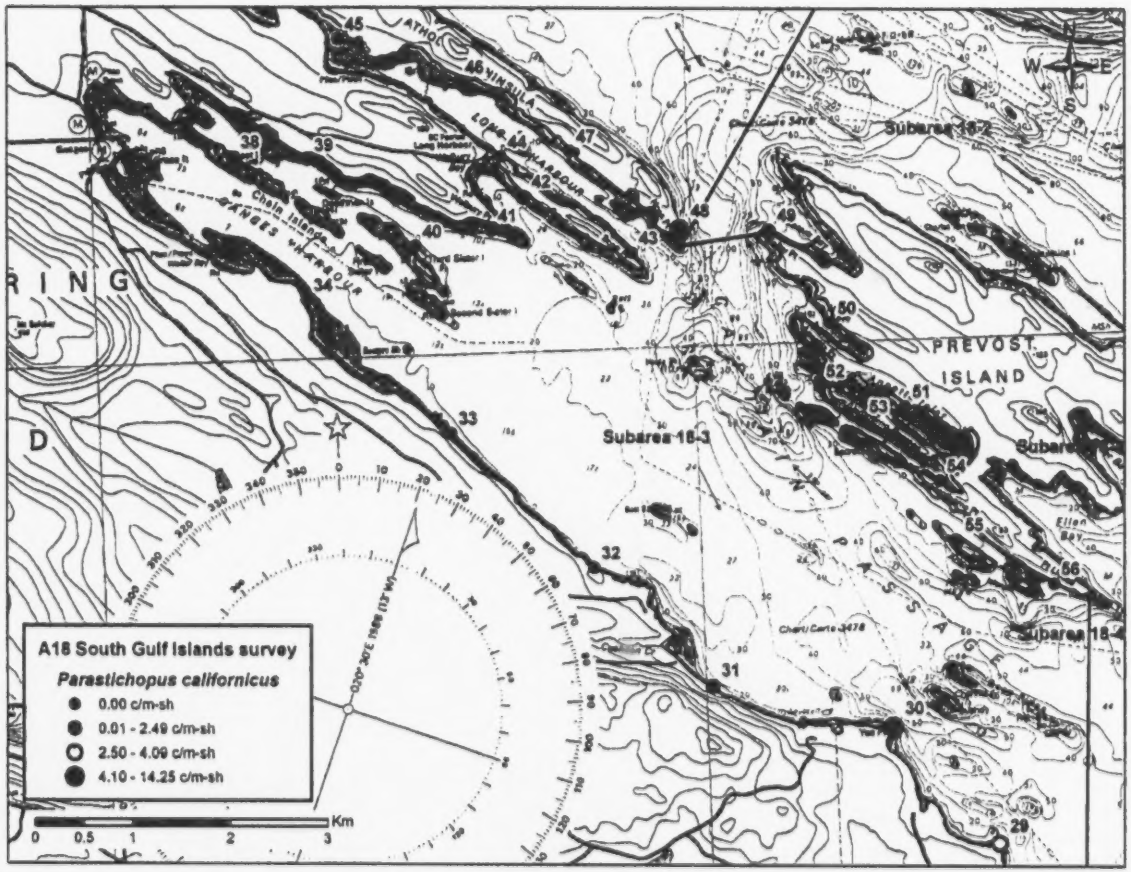

Figure 60. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 18–3, surveyed as part of the A18 South Gulf Islands survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (between 4.10 c/m-sh and the maximum observed density in the Subarea).

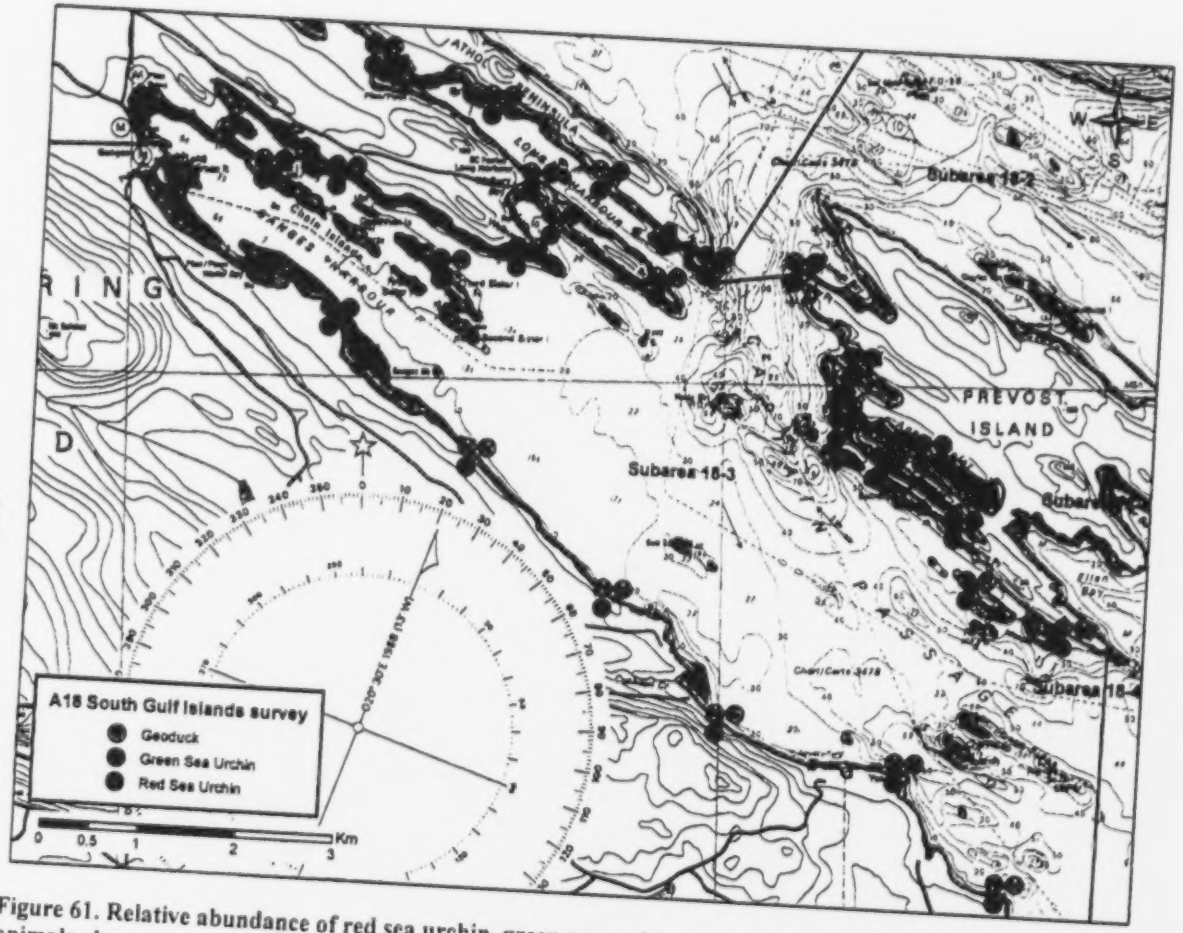

Figure 61. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 18–3. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

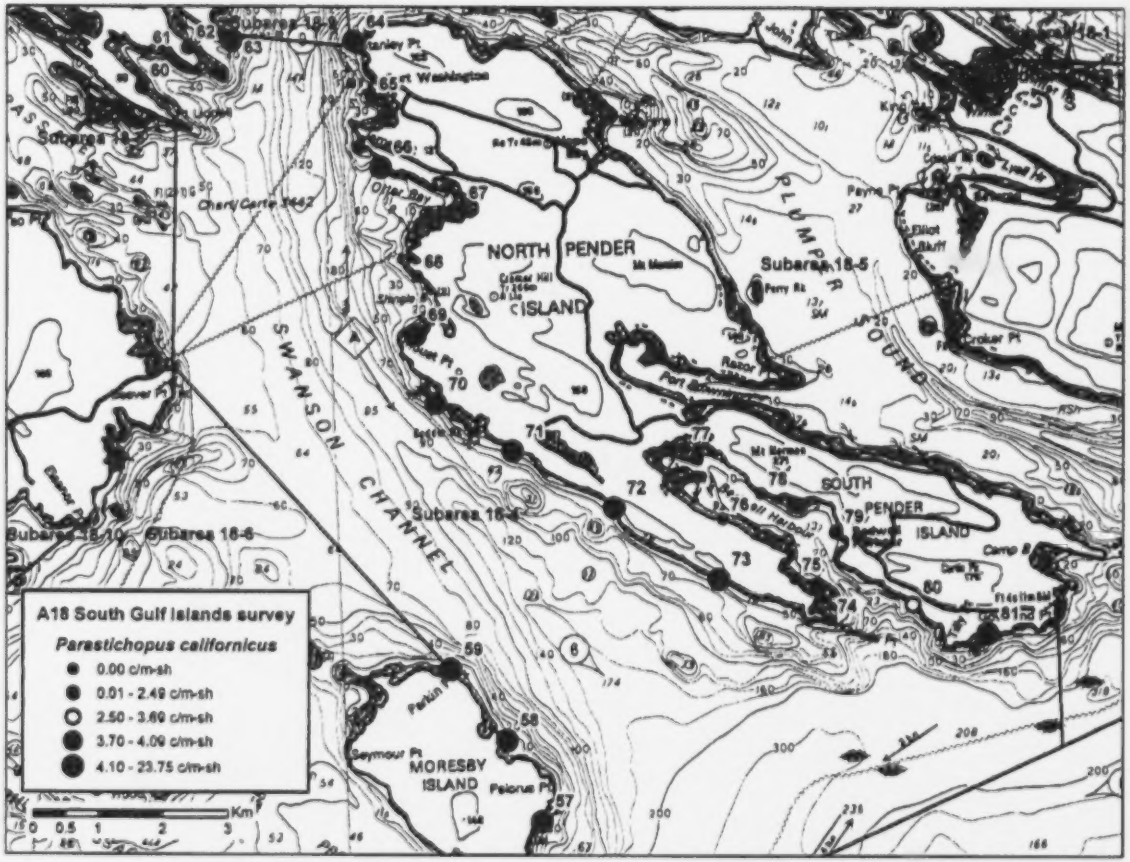

Figure 62. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 18–4, surveyed as part of the A18 South Gulf Islands survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (between 4.10 c/m-sh and the maximum observed density in the Subarea); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

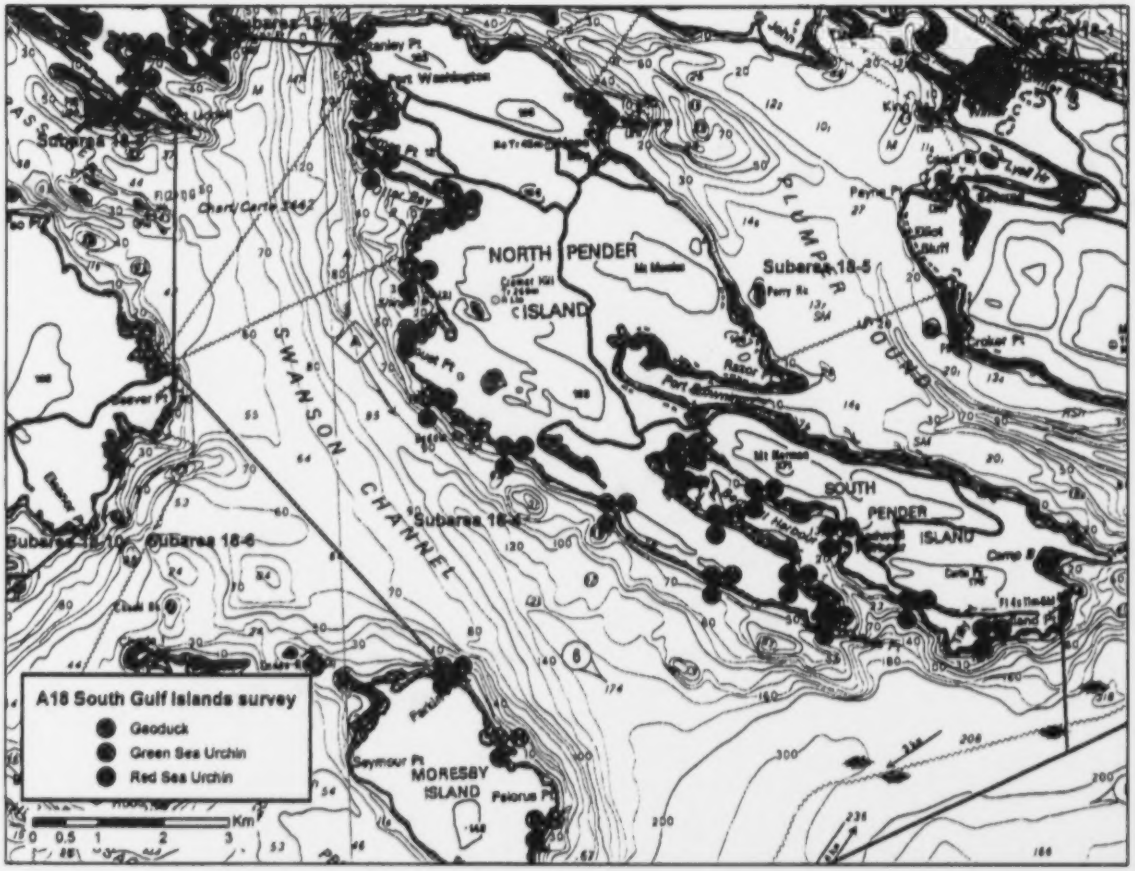

Figure 63. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 18–4. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

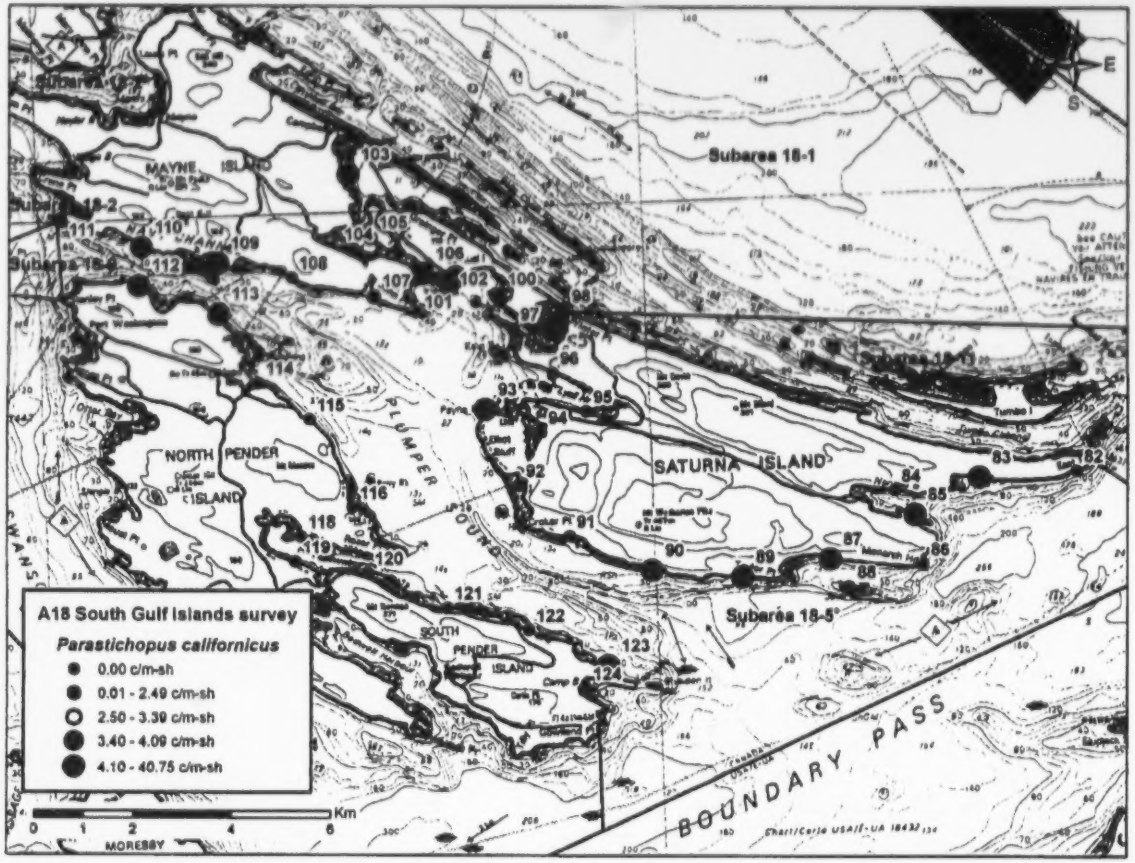

Figure 64. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 18–5, surveyed as part of the A18 South Gulf Islands survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (between 4.10 c/m-sh and the maximum observed density in the Subarea); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

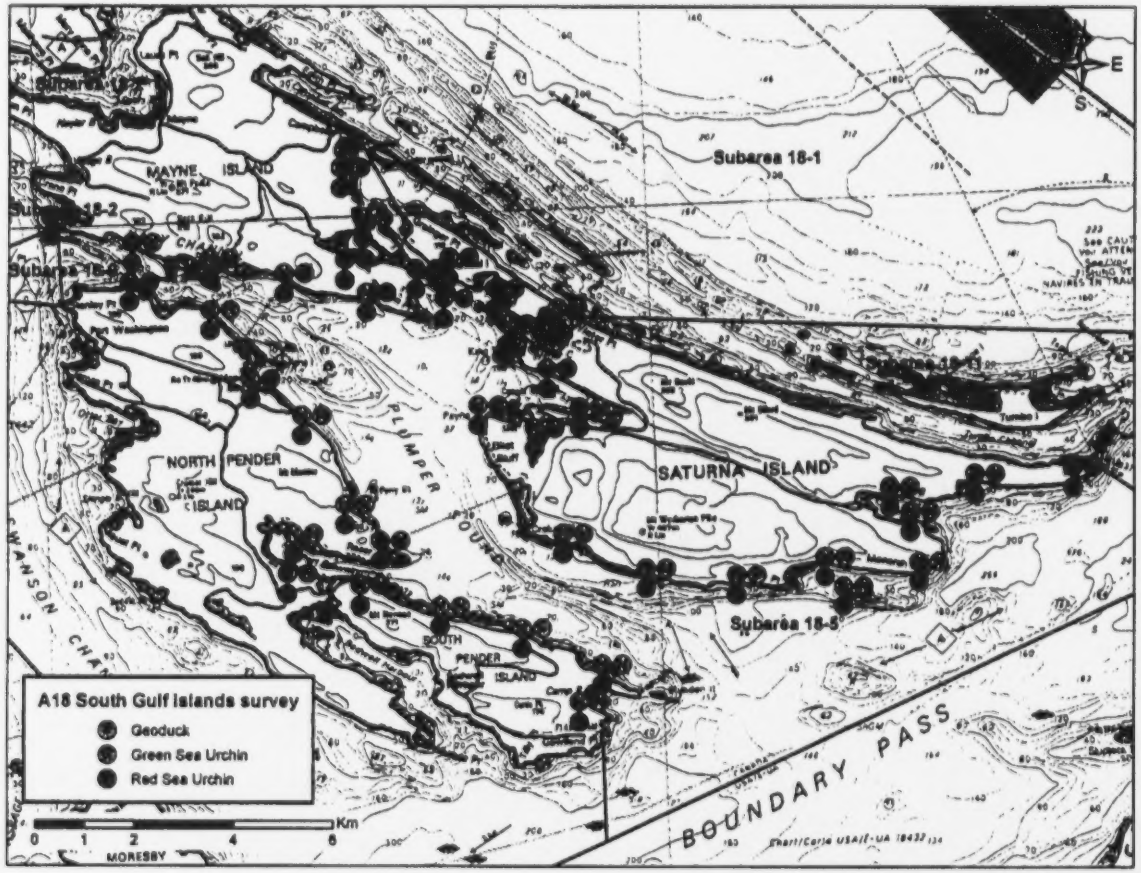

Figure 65. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 18–5. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

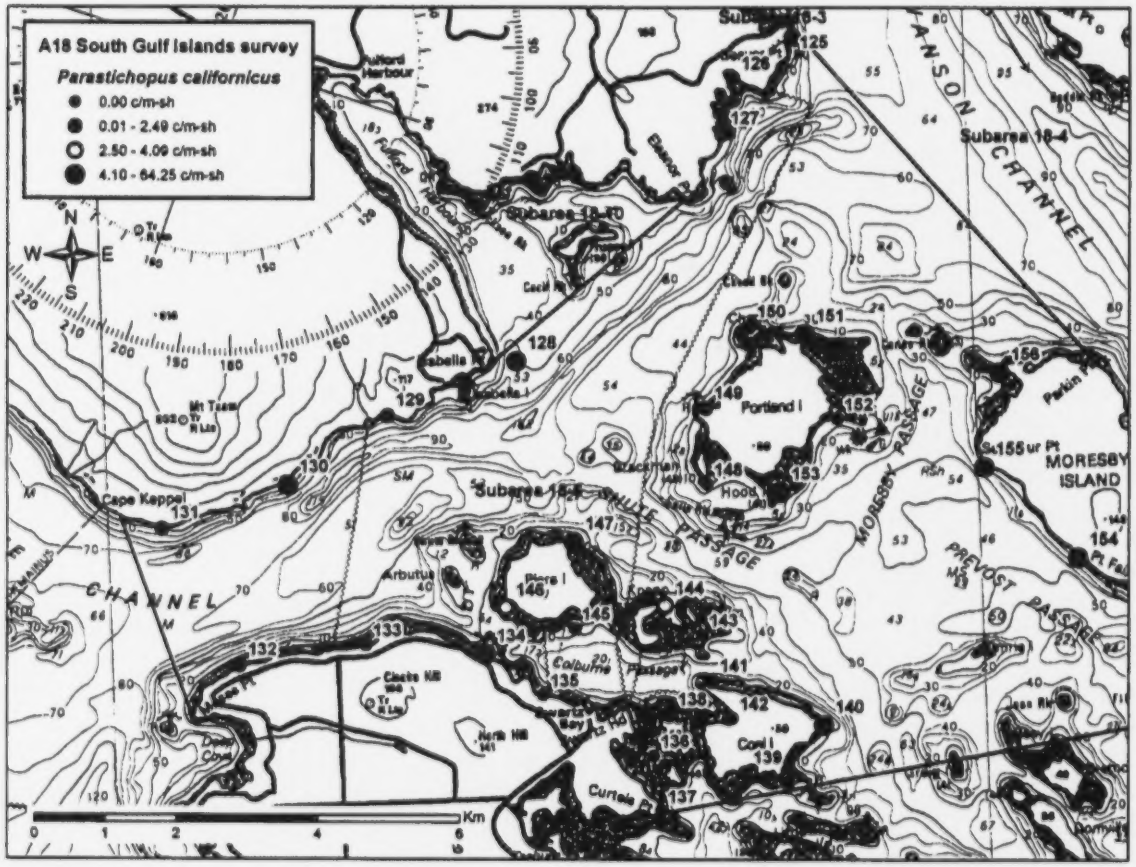

Figure 66. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 18–6, surveyed as part of the A18 South Gulf Islands survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (between 4.10 c/m-sh and the maximum observed density in the Subarea).

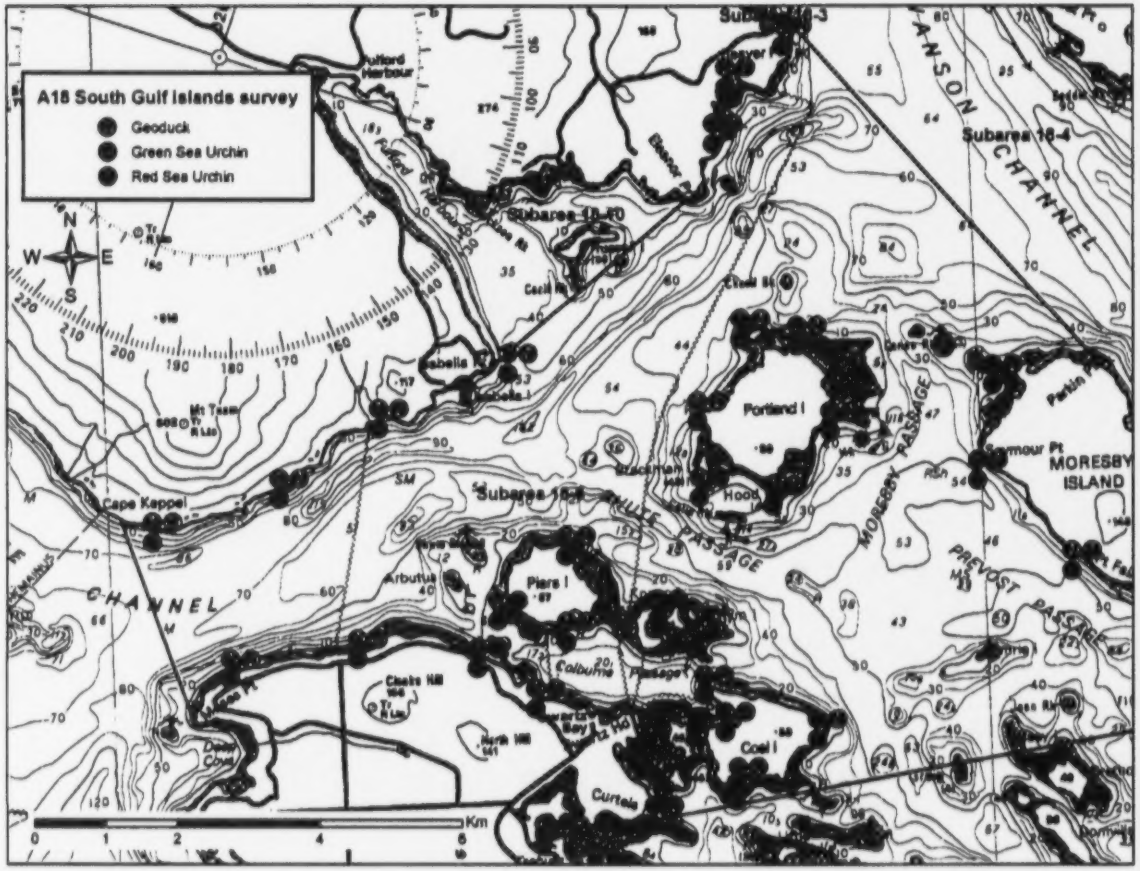

Figure 67. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 18–6. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

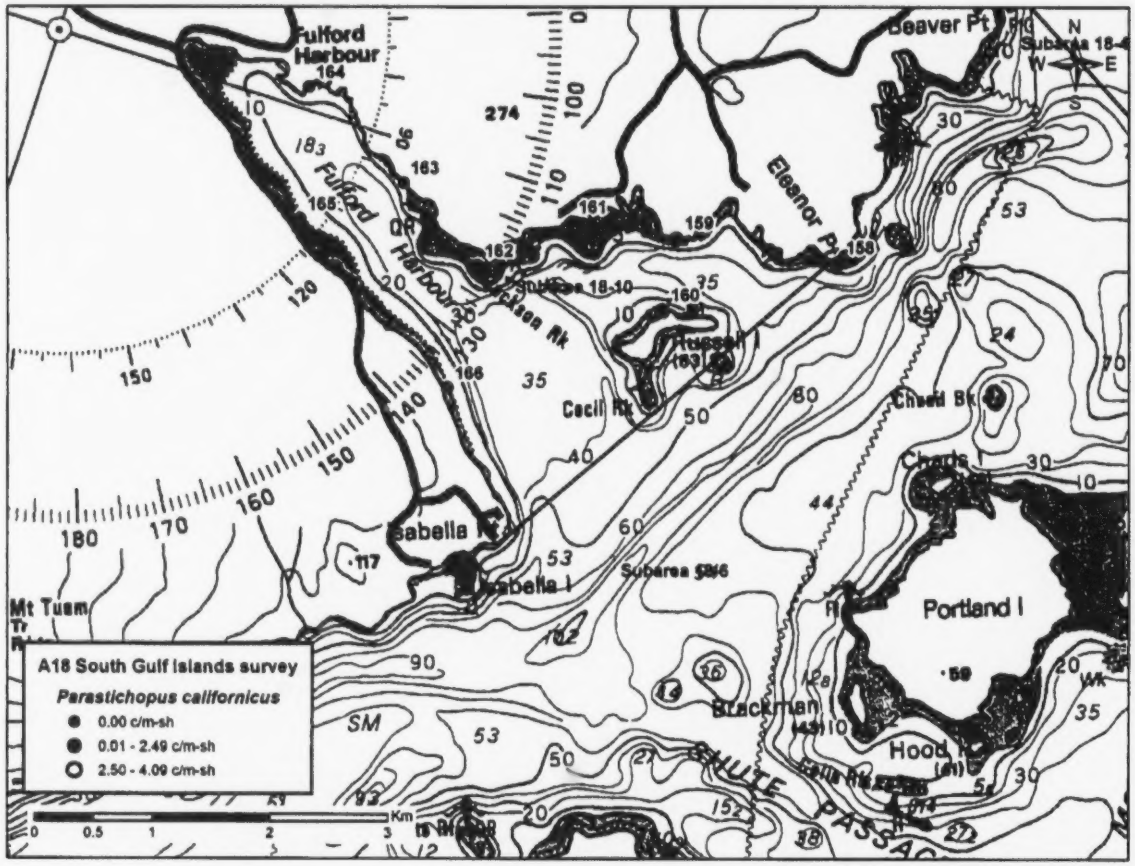

Figure 68. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 18–10, surveyed as part of the A18 South Gulf Islands survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); and yellow = medium density (between 2.5 and 4.09 c/m-sh).

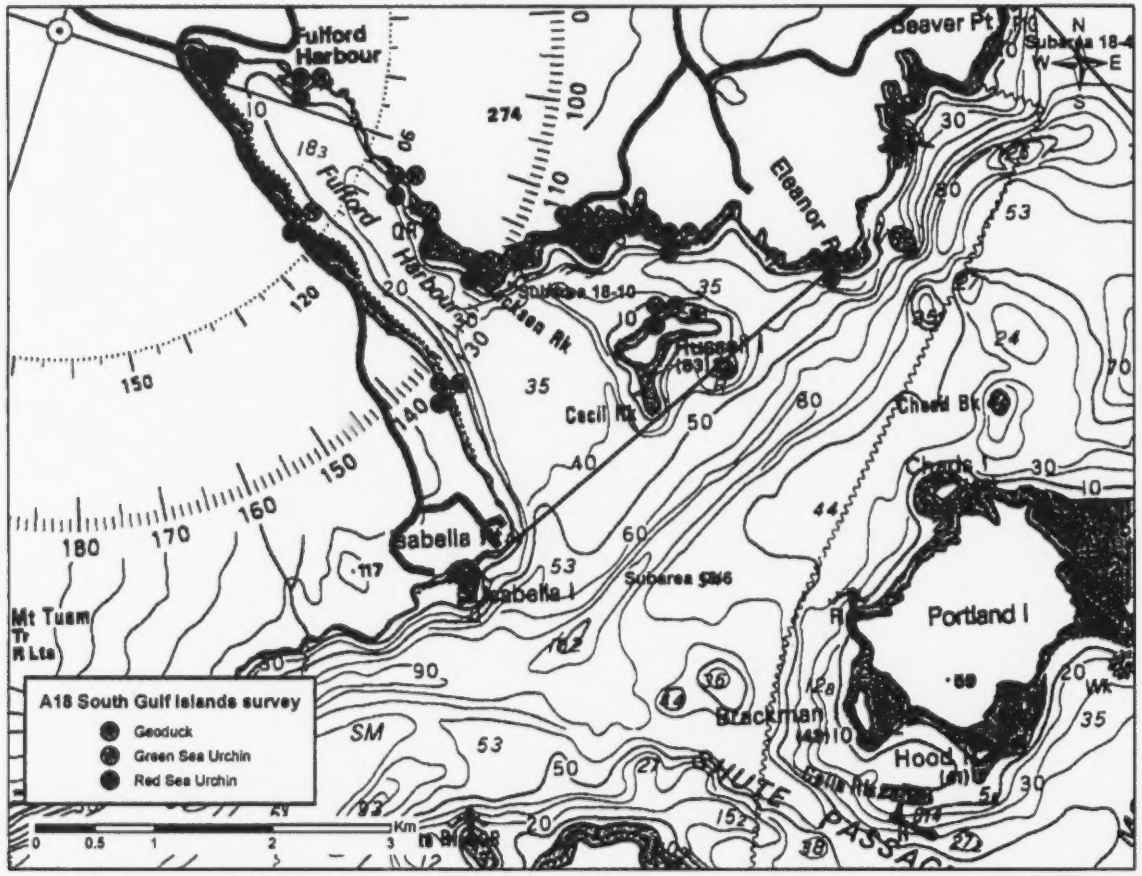

Figure 69. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 18–10. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.

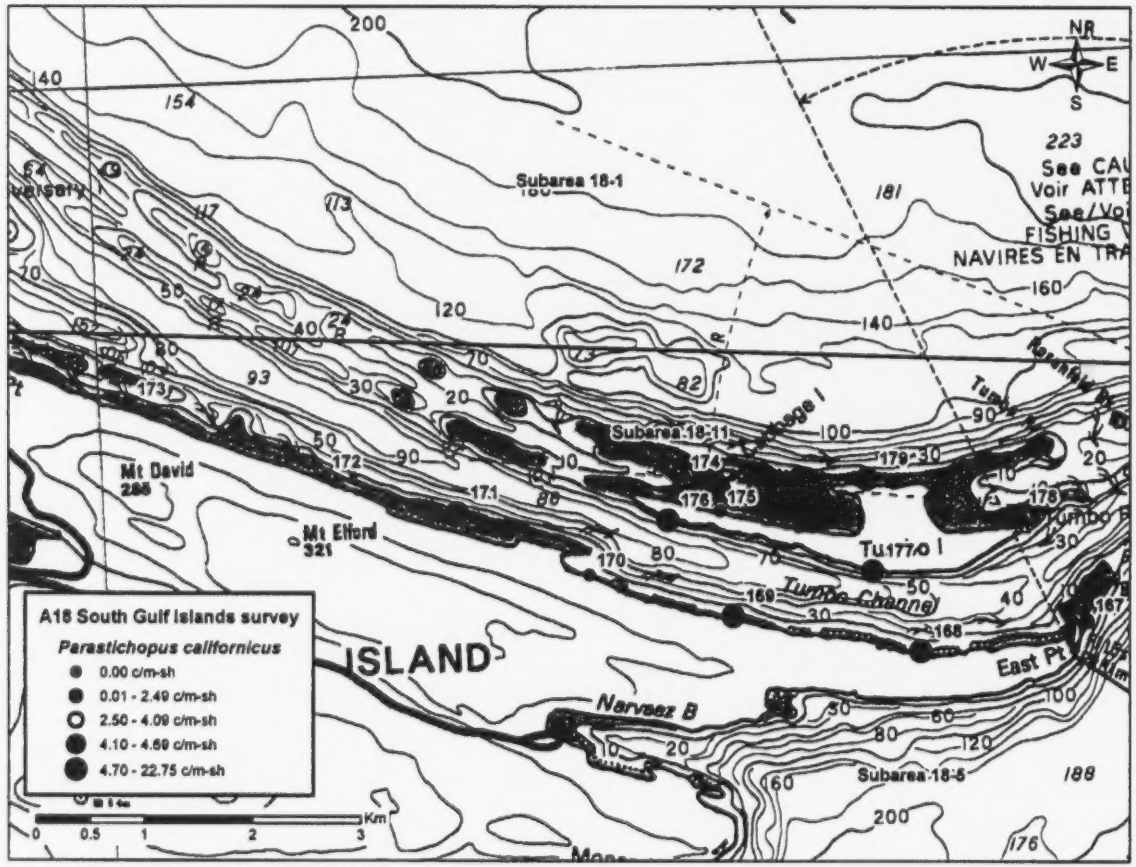

Figure 70. Linear density (sea cucumbers per metre of shoreline; c/m-sh), of *Parastichopus californicus* in PFMA 18–11, surveyed as part of the A18 South Gulf Islands survey in 2011. Each coloured dot indicates the locations of a survey transect identified by the transect number above the dot. Black = zero; red = low density (<2.5 c/m-sh); yellow = medium density (between 2.5 and 4.09 c/m-sh); green = productive locations (between 4.10 c/m-sh and the 90% lower confidence bounds); blue = very productive locations (densities above the bootstrapped lower 90% confidence bound for the Subarea).

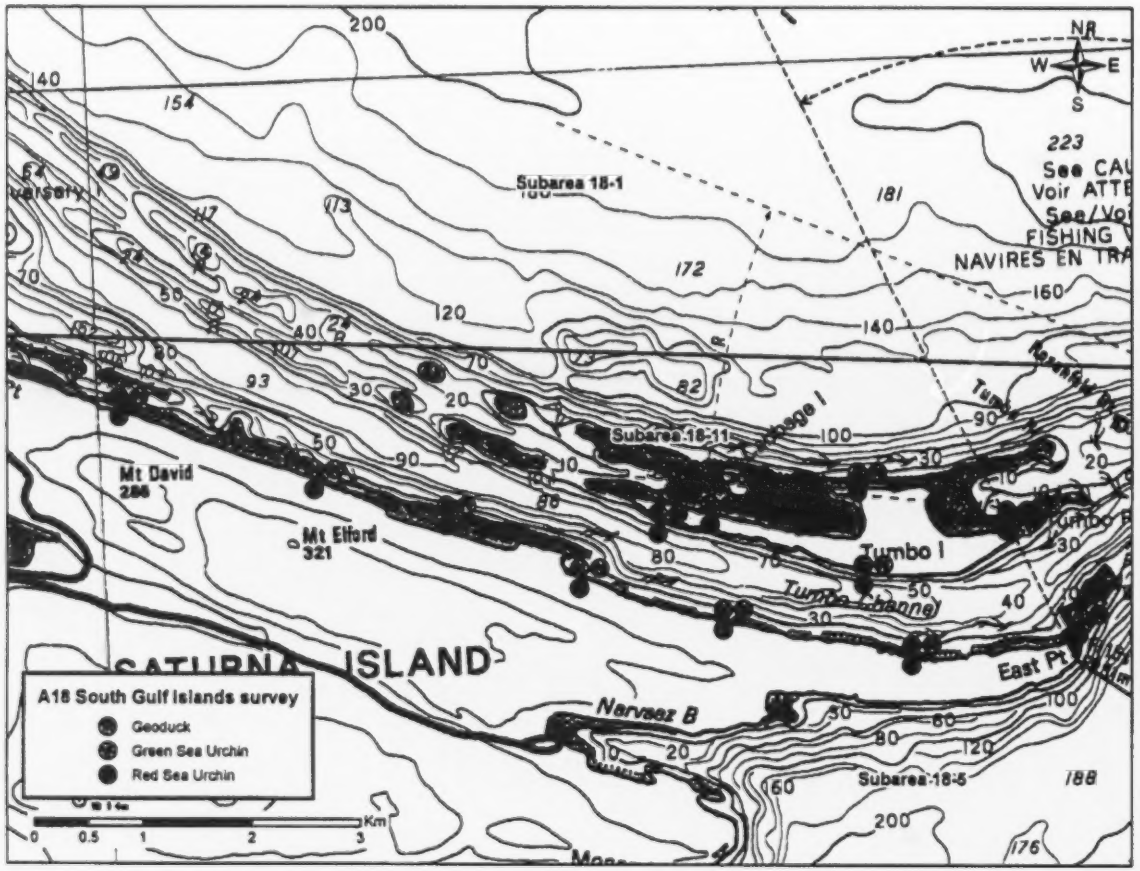

Figure 71. Relative abundance of red sea urchin, green sea urchin and geoduck on transects surveyed for sea cucumber in PFMA 18–11. The number of animals observed while swimming the transect is noted and given an abundance category: A=Abundant (101+ animals); M=Many (11-100 animals); F=Few (1-10 animals); N=zero animals.